Automatic Weather Station
MAWS301

INSTALLATION MANUAL

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VAISALA

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CHAPTER 1

GENERAL INFORMATION

About This Manual

This manual provides information for installing MAWS301 Automatic Weather Station with meteorological sensors.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides important safety, revision history, contact, and warranty information for the product.
- Chapter 2, Product Overview, introduces the MAWS Automatic Weather Station features, advantages, and the product nomenclature.
- Chapter 3, Selecting Location, provides information for locating the weather station and its sensors.
- Chapter 4, Installation, provides you with information that is intended to help installing MAWS and its sensors.

Safety

General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE	Note highlights important information on using the product.

Product Related Safety Precautions

MAWS has been tested for safety and approved as shipped from the factory. The following safety precautions are not related to any specific procedures and therefore do not appear elsewhere in this manual. They are recommended precautions that personnel must understand and apply during different phases of operation and maintenance.

WARNING	Keep away from live circuits. Operating personnel must observe safety regulations at all times. Component replacement or internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist for some time even with the power cable disconnected. To avoid injuries, disconnect power and discharge circuits before touching them.

WARNING	Do not service alone. Under no circumstances should any person reach into parts and assemblies that are mains powered and alive, for the purpose of servicing, except in the presence of someone who is capable of rendering aid.

WARNING Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

WARNING Do not service a live system outdoors. Do not open units outdoors when the enclosure contains line voltage levels.

WARNING Do not operate in an explosive atmosphere, for example when flammable gases or fumes are present. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

WARNING Do not substitute parts or modify the instrument. Because of the danger of introducing additional hazards, do not install unsuitable parts in the instrument. Contact Vaisala or its authorized representative for repairs to ensure that safety features are maintained.

WARNING Be careful when erecting the mast. See that there are no power lines or other obstacles above the mast.

WARNING Secure the mast properly to prevent it from falling. Tighten all the adjustment screws securely.

CAUTION Do not make changes to the wiring. Incorrect wiring can damage the device and prevent it from operating correctly.

NOTE When disposing of old batteries, be sure to do so in accordance with all regulations applicable in your area.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself to the equipment chassis before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.
- Always hold the boards by the edges and avoid touching the component contacts.

Version Information

Table 1 Manual Revisions

Manual Code	Description
M010077en-A	First manual version, published in June 2001.
M010077en-B	This manual.

Related Manuals

Table 2 Related Manuals

Manual Code	Manual Name
DSU12T0	DSU12 Sun Detector - User's Guide
M010030en	WMS301&302 (QMW110) - Quick Reference Guide
M010069en	YourVIEW Weather Display for MAWS - User's Guide
M010077en	MAWS301 - User's Guide
M010141en	MAWS Lizard Setup Software - User's Guide
M210222en	Using WD30(tu) and WD20 with MAWS - Technical Reference
M210223en	Using DD50 with MAWS - Technical Reference
M210265en	Configuring QSE101 Shaft Encoder with MAWS Lizard - Technical Reference
M210266en	Configuring QST101 GOES Transmitter - Technical Reference
M210267en	Configuring Modem Options - Technical Reference
N257en	MAWS Software loading - Technical Notice
M010146en	PWD11 Present Weather Detector - User's Guide
M010147en	PWD21 Present Weather Detector - User's Guide
T647en	WHP25 - Technical Reference
U059en	CT25K Ceilometer - User's Guide
U106en	FD12P Weather Sensor - User's Guide
U146en	WHP25 - Quick Reference Guide
U184en	WAA151 - Quick Reference Guide
U185en	WAV151 - Quick Reference Guide
U234en	FD12 Visibility Meter - User's Guide
U363en	WT500-series Digital Transmitters - User's Guide
U428en	WAS425 - User's Guide
U430en	WAA252 Description and Technical Data - Quick Reference Guide
U431en	WAA252 Installation and Maintenance - Quick Reference Guide
U432en	WAV252 Description and Technical Data - Quick Reference Guide
U433en	WAV252 Installation and Maintenance - Quick Reference Guide

Getting Help

Contact Vaisala technical support:

E-mail helpdesk@vaisala.com
Telephone +358 9 8949 2789
Fax +358 9 8949 2790

Warranty

Vaisala hereby represents and warrants all Products manufactured by Vaisala and sold hereunder to be free from defects in workmanship or material during a period of twelve (12) months from the date of delivery save for products for which a special warranty is given. If any Product proves however to be defective in workmanship or material within the period herein provided Vaisala undertakes to the exclusion of any other remedy to repair or at its own option replace the defective Product or part thereof free of charge and otherwise on the same conditions as for the original Product or part without extension to original warranty time. Defective parts replaced in accordance with this clause shall be placed at the disposal of Vaisala.

Vaisala also warrants the quality of all repair and service works performed by its employees to products sold by it. In case the repair or service works should appear inadequate or faulty and should this cause malfunction or nonfunction of the product to which the service was performed Vaisala shall at its free option either repair or have repaired or replace the product in question. The working hours used by employees of Vaisala for such repair or replacement shall be free of charge to the client. This service warranty shall be valid for a period of six (6) months from the date the service measures were completed.

This warranty is however subject to following conditions:

a) A substantiated written claim as to any alleged defects shall have been received by Vaisala within thirty (30) days after the defect or fault became known or occurred, and

b) The allegedly defective Product or part shall, should Vaisala so require, be sent to the works of Vaisala or to such other place as Vaisala may indicate in writing, freight and insurance prepaid and properly packed and labeled, unless Vaisala agrees to inspect and repair the Product or replace it on site.

This warranty does not however apply when the defect has been caused through

a) normal wear and tear or accident;

b) misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;

c) wrong installation or assembly or failure to service the Product or otherwise follow Vaisala's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by Vaisala or replacements with parts not manufactured or supplied by Vaisala;

d) modifications or changes of the Product as well as any adding to it without Vaisala's prior authorization;

e) other factors depending on the Customer or a third party.

Notwithstanding the aforesaid Vaisala's liability under this clause shall not apply to any defects arising out of materials, designs or instructions provided by the Customer.

This warranty is expressly in lieu of and excludes all other conditions, warranties and liabilities, express or implied, whether under law, statute or otherwise, including without limitation ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE and all other obligations and liabilities of Vaisala or its representatives with respect to any defect or deficiency applicable to or resulting directly or indirectly from the Products supplied hereunder, which obligations and liabilities are hereby expressly cancelled and waived. Vaisala's liability shall under no circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall Vaisala in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damages.

CHAPTER 2

PRODUCT OVERVIEW

This chapter introduces the MAWS Automatic Weather Station features, advantages, and the product nomenclature.

Introduction to MAWS301

MAWS301 Automatic Weather Station is a new generation automatic weather station especially designed for applications where no commercial power or communication networks are present, or are too expensive to be installed. Due to its flexibility and economical design, MAWS301 is also an ideal choice for hydrometeorological and hydrological applications. The possibility to use the same and standard equipment for many different requirements lowers the cost of training, spare parts, and logistic support.

MAWS301 has been designed for applications where only a few sensors are required. However, MAWS301 can be easily upgraded, even in the field, to include a larger set of sensors including smart sensors such as ceilometer, visibility and present weather sensors, and water quality probes. The same basic system with its options and accessories can provide with all the needs of meteorological and hydrological networks. The MAWS301 options are listed in Table 4 on page 18, Table 5 on page 19, and Table 6 on page 19.

The system setup is done using Lizard Setup Software. In addition, there are some generic sensor inputs in the Lizard software, allowing for limited flexibility to add new sensors to the system.

The system configuration can vary from small hydrological systems (see Figure 1 on page 16) to large integrated systems (see Figure 2 on page 17).

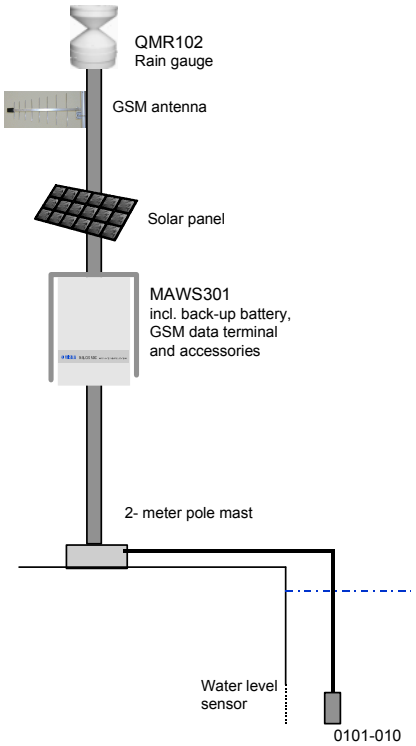


Figure 1 MAWS301 Hydrological System

MAWS301 is easy to install and maintain. All connections are made using pre-wired connections. The sensors are equipped with ready-made cables and connectors/glands for quick installation. All optional modules such as battery regulator, AC power supply, and surge arrestors are easily mounted on a DIN rail.

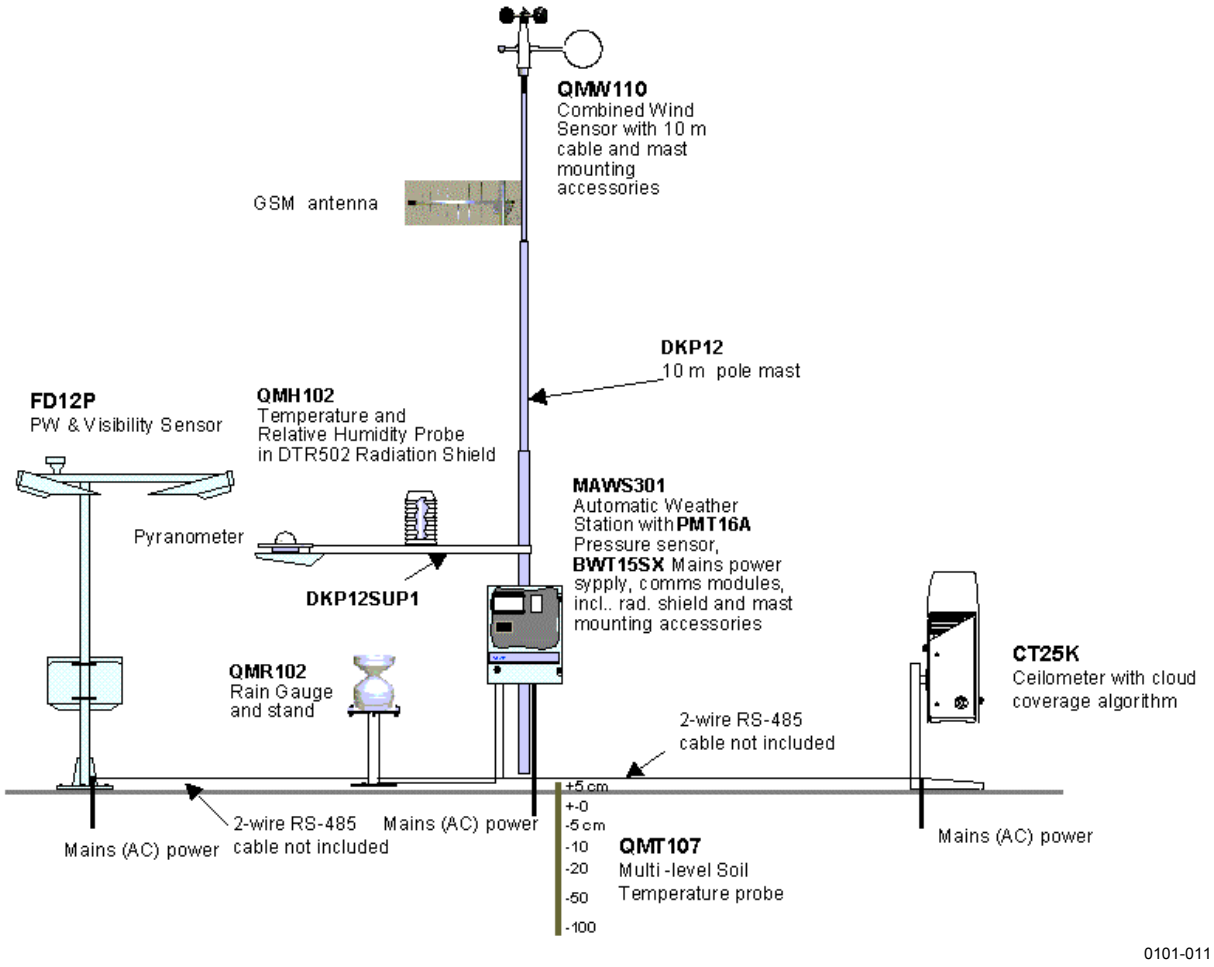


Figure 2 MAWS301 Integrated System

Product Nomenclature

Table 3 MAWS Nomenclature (Basic Set)

Code	Common Name
BOX501	Equipment enclosure
MAWS Lizard	Setup software
MAWS Terminal	MAWS Terminal software
MAWS YourVIEW	Graphical Display Software (Basic version)
QBR101	Battery regulator
QCD102	CD containing software and documentation
QML102	AWS logger (with 2 MB Flash memory)

Table 4 MAWS Nomenclature (Sensor Options)

Code	Common Name
CM11	Solar radiation sensor
CM6B	Solar radiation sensor
CT25K	Ceilometer
DCU7110	Water level sensor
DCU7210	Snow level sensor
DRD11A	Rain on/off sensor
DSU12	Sunshine duration sensor
DTR502	Radiation shield for QMH102
FD12	Visibility sensor
FD12P	Present weather sensor
ML2x	Soil moisture sensor
PMT16A	Pressure sensor
PWD11	Present weather detector
PWD21	Present weather detector
QFM101	Fuel moisture sensor
QLW101	Leaf wetness sensor
QMH102	Air temperature and relative humidity sensor
QMN101	Net solar radiation sensor
QMR102	Rain gauge (stand-alone)
QMS101	Global solar radiation sensor (photodiode)
QMS102	Global solar radiation sensor (thermopile)
QMT103	Soil/water temperature sensor with 5 m cable
QMT107	Soil Temperature Probe
QMT110	Soil/water temperature sensor with 10 m cable
QMV101	Water level sensor
QMV102	Water level sensor
QMW101	Combined wind sensor with 1 m cable
QMW110A	Combined wind sensor with 10 m cable
QSE101	Incremental Shaft Encoder
RG13H	Heated rain gauge
WAA151	Anemometer
WAA252	Heated anemometer
WAS425A	Ultrasonic wind sensor
WAS425AH	Heated ultrasonic wind sensor
WAV151	Wind vane
WAV252	Heated wind vane

Table 5 MAWS Nomenclature (Communication Options)

Code	Common Name
DMX501	Modem module (fixed line)
DSI485A	RS-485 module (isolated)
DSI486	RS-485/RS-232/SDI-12 module (dual-isolated)
DSU232	RS-232 module (dual)
GSMM20T	GSM data modem
QMMODEM	PSTN modem (SIXNET)
QST101	GOES Satellite transmitter interface
QRB101	ORBCOMM satellite transceiver set

Table 6 MAWS Nomenclature (Optional Accessories)

Code	Common Name
BWT15SXZ	Mains power supply (for outdoor use)
MAWS YourVIEW with TCP/IP	Graphical Display Software with TCP/IP connection
QMB101	Battery (internal rechargeable 6 V, 1.3 Ah)
QMBATT7	Backup battery, 12 V, 7 Ah
QMBATT12	Backup battery, 12 V, 12 Ah
QMBATT24	Backup battery set, 12 V, 24 Ah
QMC102	Memory Expansion Board
QMD101	Handheld terminal
QMG101	GPS Time Synchronizing Unit
SOLAR12	12 W solar panel
SOLAR24	24 W solar panel
26588	32 MB Compact Flash memory card for QMC102

Table 7 Installation Accessories

Code	Common Name
DKP102	2-meter pole mast
DKP12	10-meter pole mast
DKP12SUP1	Sensor support arm
DKP12SUP2	Sensor support arm
DKP15W	3-meter pole mast, incl. mounting for WT521
QMLOCKSET	Two locks with keys for BOX501
RG35003	Stand for QMR102, total height with sensor 1.5 m
RGB1	Base plate for QMR102, for installation on ground
WHP25	AC power supply for wind sensors
WT521	Digital wind transmitter

MAWS Software

Operating Software

The embedded operating software runs in the QML102 AWS logger. Access to the operating software commands can be gained using the MAWS Terminal.

Lizard Setup Software

Lizard Setup Software is used to modify the software parameters and operation of the MAWS weather station. With the Lizard software you can create or modify a setup file that informs MAWS how to operate.

Creating a setup with Lizard Setup Software consists of three stages. First, you define an assembly for the MAWS weather station. Then you define the necessary measurements and the calculations derived from them. Finally, you define reports and log groups from the measurement results.

The setup file on your PC is finally generated, in other words, converted into a format that MAWS understands, and then transferred into MAWS and taken into use.

MAWS Terminal

MAWS Terminal is a terminal software for working with MAWS Automatic Weather Stations. MAWS stations measure weather data and store it in log files. With the MAWS terminal software, you can download these files to your PC and view them.

When you start using MAWS, the first thing you need to do is to define what weather parameters you want to measure and at what frequency. You can do this by uploading a configuration file from your PC to the MAWS.

MAWS Terminal is also used for setting the station specific parameters such as the station name, altitude, pressure sensor height, and sensor specific calibration coefficients. In addition, the date and time can be set using the easy-to-use **MAWS Station Settings** template.

After you have uploaded the configuration files to the MAWS, you can browse the MAWS weather data files by downloading them from the MAWS to your PC. You can browse them in MAWS Terminal or in other applications. You can define several download settings such as where you want to save the downloaded files and what operations the program performs automatically at each download.

BOX501 Enclosure

BOX501 is a plastic enclosure reinforced with fiberglass. This enclosure has space for the AWS logger, communication equipment, battery charger, and maintenance free lead-acid batteries of different sizes. In addition, optional devices such as AC power supply and protective devices for communication lines can be installed inside the enclosure. All of the devices are installed on an easy-to-remove DIN-rail except the backup battery, which is installed with a fixed-screw mounting clamp.

The enclosure material is highly resistant to corrosion, ultra-violet radiation, chemicals, and atmospheric agents. The enclosure is dust tight and sealed against water jets. The door opening is to the right with an opening angle of 190 degrees. The door sealing is ensured by using an extruded polyurethane foam gasket. The door is locked with a standard locking tool (lock with a key is available as an option).

BOX501 has a metal radiation shield painted white. This shield gives additional protection against excessive sunshine and falling material such as ice and tree branches, for example.

In addition, the BOX501 enclosure has a pressure compensation element installed at the bottom plate. This element compensates for varying degrees of pressure caused by the temperature differences. This membrane element together with high quality plastic material significantly reduces water condensation inside the enclosure.

For future needs, the BOX501 enclosure has space reserved for optional devices. These can be mounted on the two DIN-rails or on the installation plate on the enclosure door.

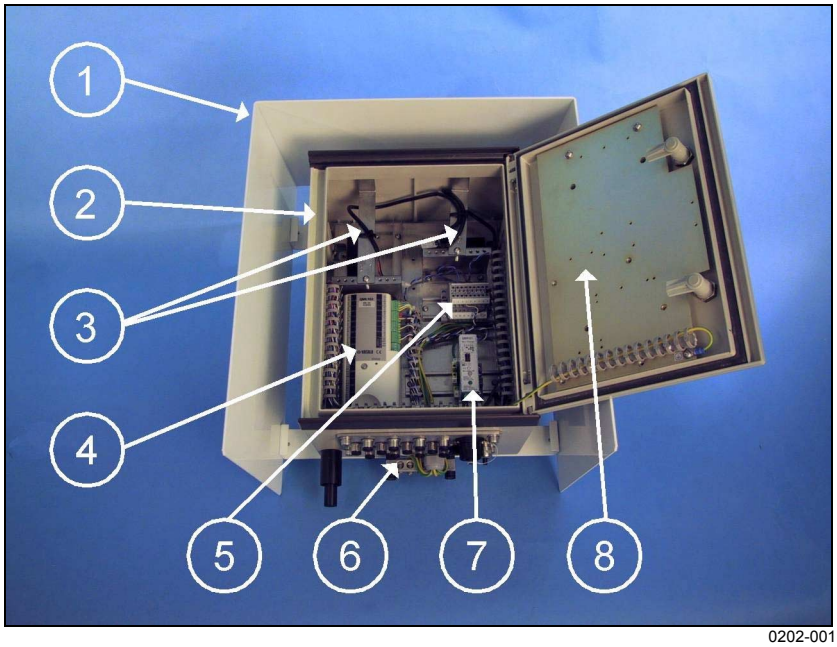


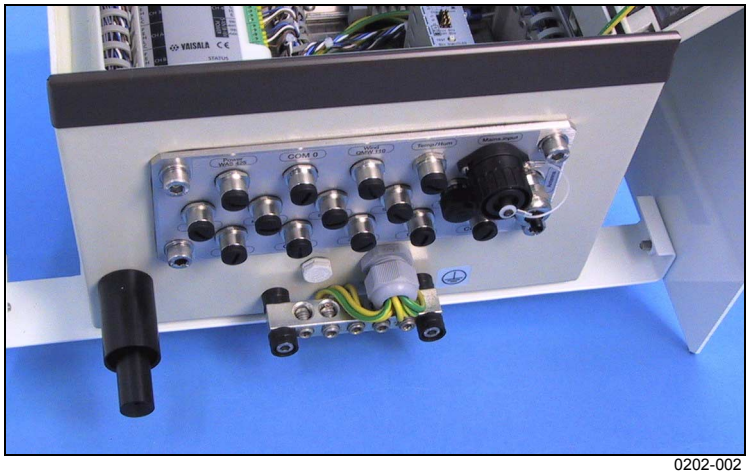
Figure 3 BOX501 Enclosure with Radiation Shield

The following numbers refer to Figure 3 above.

1 = The radiation shield
2 = The BOX501 enclosure
3 = The places for the batteries
4 = The logger
5 = The terminal strip
6 = The pressure compensation element
7 = The battery regulator
8 = The installation plate on the door

All sensors, power supply and communication devices are connected to the equipment inside the enclosure via environmentally sealed connectors. Each connector is identified individually with a label. See Figure 4 on page 23.

The atmospheric pressure sensor is located on the CPU board of the AWS Logger. There is a static pressure head for venting out the pressure sensor, thus minimizing the wind effect on the pressure measurement.



0202-002

Figure 4 Bottom View of BOX501 Enclosure

QML102 AWS Logger

0105-001

Figure 5 QML102 Logger

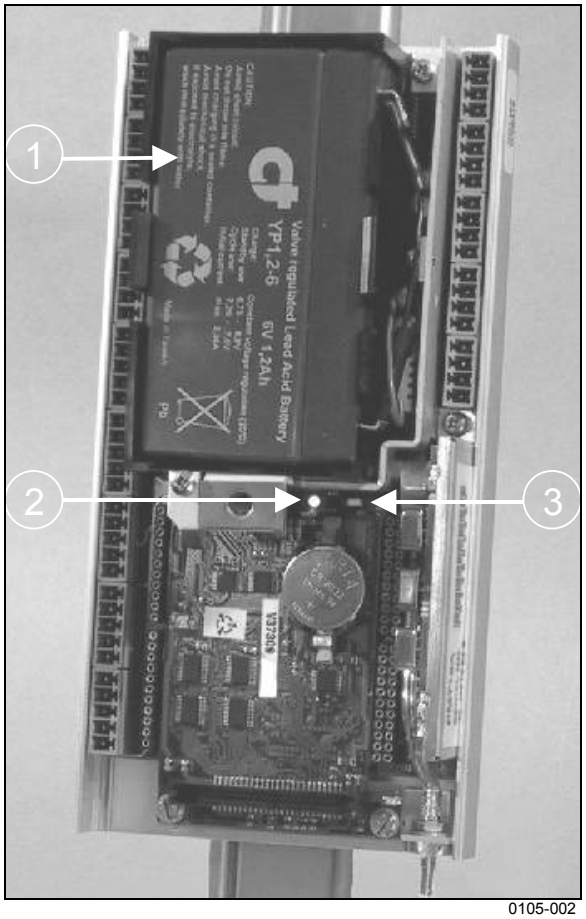
QML102 is a complete AWS designed on one printed board only. This board contains a 32 bit Motorola CPU for data processing and 10 differential (20 single ended) analog sensor inputs (these can also be used as digital inputs). Moreover, there are two frequency sensor interfaces, a 16 bit A/D converter, 1.7 Mbytes of secure Flash memory for data logging, as well as power supply and charger for the internal

backup battery of 1.3 Ah/6V. The last mentioned is optional in the systems where a backup battery with higher capacity is used.

The board uses the latest SMD (Surface Mount Device) technology and is conformal coated for improved protection also in high humidity. Each sensor input has a varistor (VDR) protection against induced transients. The maintenance terminal connection (RS-232, COM0) has transzorb diodes in its inputs.

The cover of the QML102 logger can be removed for installation of the battery and for resetting MAWS. In Figure 6 below, QML102 is shown without the cover and the communication modules.

When long signal cables are needed, these will be equipped with optional surge voltage protection devices. These surge arrestors consist of a combination of VDR, gas-filled discharge tube, transzorb diodes and coils, thus providing excellent protection. These DIN rail mountable devices are easy to change without any special tools.



0105-002

Figure 6 QML102 Logger without Cover

The following numbers refer to Figure 6 on page 24.

1 = Internal battery
2 = Reset button
3 = Status LED

Optional modules include, for example, the Compact Flash memory card, various communication modules, and built-in pressure transducer.

Memory Expansion Board (Optional)

QML102 AWS Logger can be equipped with QMC102 Memory Expansion Board. This module uses the standard Compact Flash memory cards, same as used in some digital cameras, for logging a large amount of data.

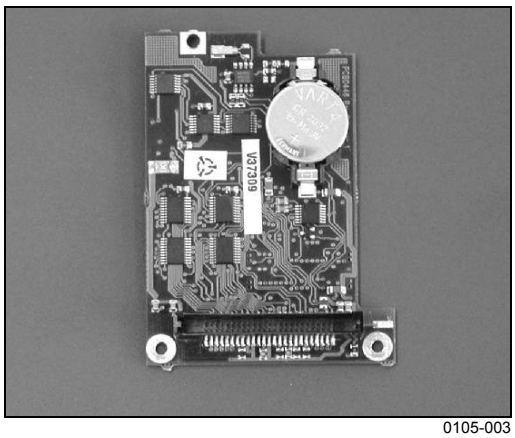


Figure 7 QMC102 Memory Expansion Board

The data is logged into the daily files making it easy to locate any particular data set for further analysis.

Currently there are cards available from 32 MB up to 280 MB. These cards can be read directly in the PC. Several different types of readers are commercially available: internal PCMCIA reader as well as external readers to be connected to USB or parallel port of a PC.

0105-004

Figure 8 Compact Flash Memory Card Readers

Power Supplies

MAWS301 is a low-power system. The basic QML102 AWS logger consumes only less than 10 mA from a 6 V battery. It can be powered using a small size solar panel or optionally using a 110/230 AC power supply. The power consumption of the complete MAWS301 system depends on the connected sensors, communication devices and other options included in the delivery.

Solar Panels

MAWS301 is typically powered by SOLAR12, a 12 W solar panel. When higher power consumption is used (e.g. communication equipment), the system uses SOLAR24, a 24 W solar panel, to guarantee trouble-free and continuous operation.

The solar power package also includes mast mounting accessories and a 6-meter cable with the connector. The angle of the panel is adjustable.

SOLAR12

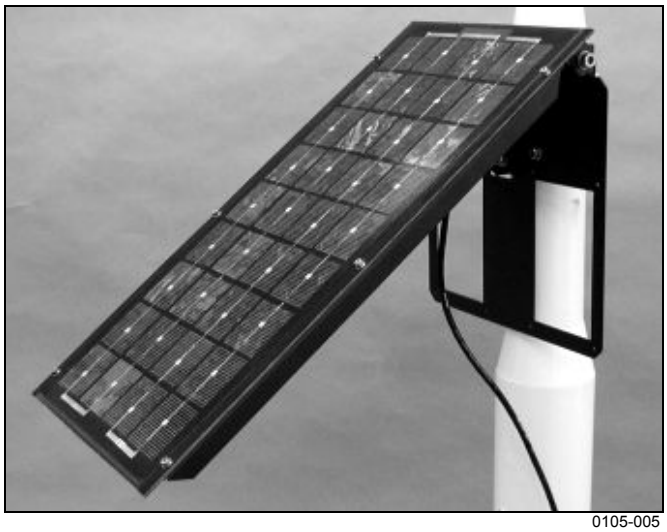


Figure 9 SOLAR12 Solar Panel

The SOLAR12 solar panel is a custom-designed module incorporating high power efficiency, quality and ruggedness. The 12 W panel contains 36 polycrystalline silicon cells. The cells are protected from dirt, moisture, and mechanical impact by a tough fluoropolymer front film. The solar circuit is laminated using EVA between this film and a durable glass fiberboard back sheet for superior moisture resistance. The SOLAR12 modules have lightweight, high power and robust construction.

SOLAR24

SOLAR24 solar panels are custom-designed modules incorporating high power efficiency and quality. The 24 W panel contains 36 polycrystalline silicon cells. The cells are protected from dirt, moisture and mechanical impact using a tempered, low iron glass front. The solar circuit is laminated using EVA between tempered glass and a durable, multi-layered polymer back sheet for superior moisture resistance.

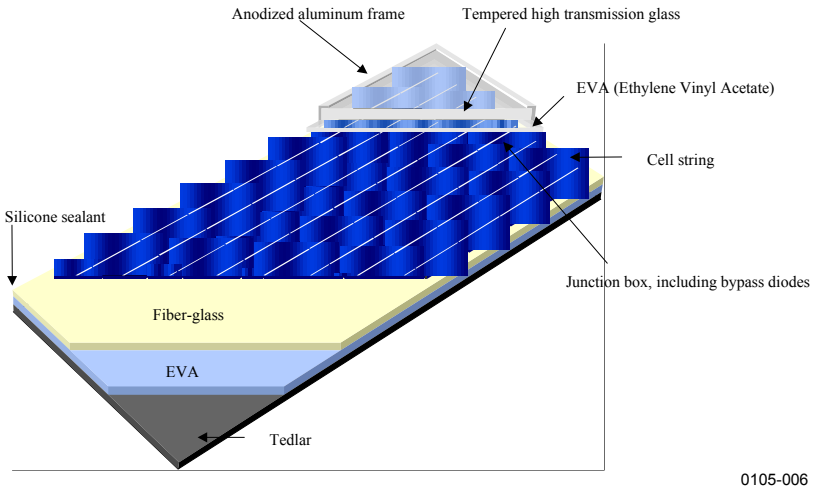


Figure 10 Solar Panel Layers

Backup Battery and Regulator

There are three alternative backup batteries available: 7 Ah, 12 Ah, or 24 Ah. The size of the backup battery depends on the system configuration (options) and the required backup time. The batteries are charged by solar panel using QBR101 Battery Regulator. Optionally, the backup battery can also be charged through the AC power supply when included in the system.

The batteries are sealed and maintenance free.

QMB101 Internal Battery

The MAWS301 system usually uses large backup batteries. Therefore, the internal battery QMB101 is optional and is used only if the backup battery is not used. QMB101 battery is placed on top of the circuit board, under the logger cover. See Figure 6 on page 24.

Backup capacity with average power consumption of 10 mA (basic set of 5 sensors, 10 min measuring interval) is 130 hours. The battery can be charged with the QML102 logger.

NOTE When a 12 V backup battery is used, it is recommended that QMB101 be disconnected by removing the red battery connector from the CPU. This way the current consumption will be reduced when the charging circuits of QMB101 are not in use.

QBR101 Battery Regulator

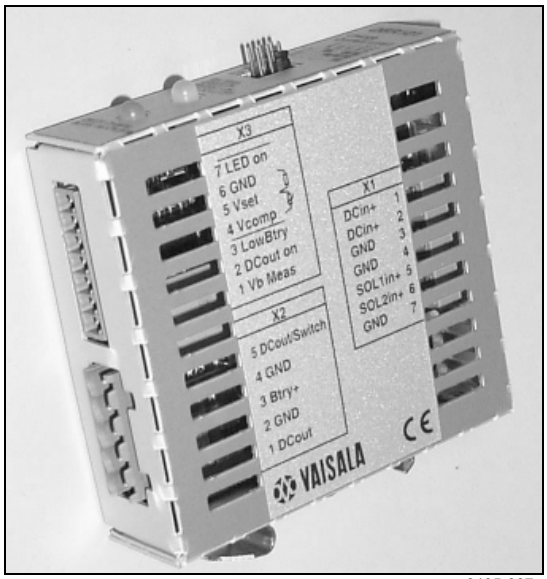


Figure 11 QBR101 Battery Regulator

QBR101 Battery Regulator is a charging and supervising equipment for 12/24 Volts lead acid and nickel-cadmium batteries. QBR101 allows simultaneous input from both a solar panel and AC power (BWT15SXZ).

The maximum charging current can be set by the internal jumper settings between 0.5 to 2.5 A being applicable for battery capacity of 4 to 72 Ah. The self-consumption from the battery is very low, less than 0.2 mA, which is required at installations at remote locations.

Also included are LED lamps which indicate the conditions. In order to maximize autonomy time, the lamps are activated only while pressing the ON button. QBR101 is a rail-mountable unit allowing easy maintenance.

AC Power Supply (Optional)

The Mains power supply unit BWT15SXZ is a switching power supply, which operates from the universal AC input of 85 to 264 VAC and 47 to 440 Hz. The output voltage is 15 VDC, which is used for powering the MAWS301 system, and as an input to the QBR101 battery regulator for charging the backup battery.

BWT15SXZ is installed inside the BOX501 on a standard DIN-rail enabling easy maintenance of the unit.

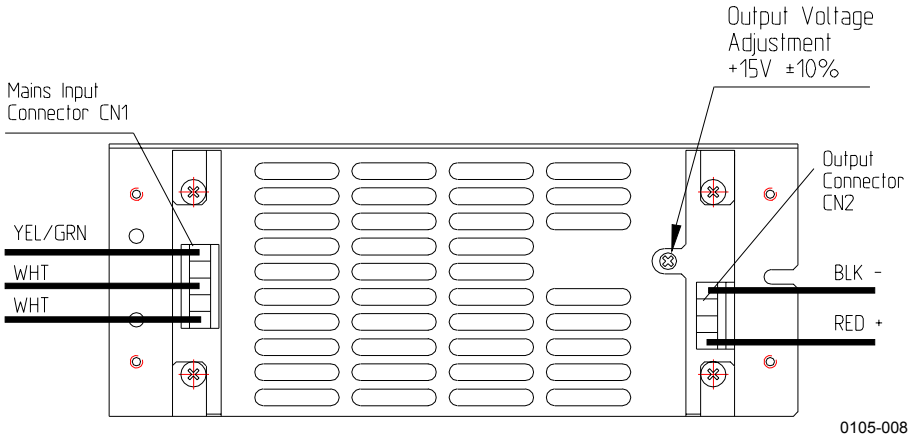


Figure 12 Mains Power Supply BWT15SXZ (Top View)

Sensors

Wind Sensors

QMW110A

Figure 13 QMW110A Wind Sensor

QMW110A is a compact sized wind sensor with the wind speed and direction sensors integrated into one unit. A single compact sensor is ideal for low-power applications. The rotating cup anemometer at the top of the unit provides isotropic and linear response to wind speed. The vane attached to the body of the unit provides fast response to wind direction.

The cup wheel shape, dimensions and material have been carefully designed to achieve maximum quality of measurement. The conical cups have been tested to give linear response between wind speed and

angular velocity of the cup wheel. The polyamide plastic reinforced with carbon fiber guarantees a rigid structure even at the highest wind speeds.

The balanced wind vane is integrated in the housing, underneath the cup wheel. The circular tail is located far enough from the body and the cup wheel to avoid turbulences due to these structures. The vane assembly is of PA (reinforced with glass fiber) providing durable and lightweight structure with fast response and low inertia.

WAA151

0105-012

Figure 14 WAA151 Anemometer

WAA151 Anemometer is an optoelectronic, fast-response, low-threshold wind speed sensor. In the cup wheel, it has three lightweight conical cups providing excellent linearity over the entire operating range, up to 75 m/s.

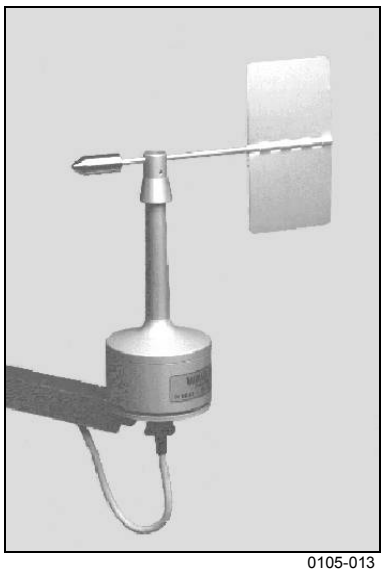
A heating element in the shaft tunnel keeps bearings above the freezing level in cold climates. Nominally, it provides 10 W of heating power. It is recommended to use a thermostat switch in the sensor cross arm for switching the heating power on below +4 °C.

WAV151

WAV151 is a counter-balanced, low-threshold optoelectronic wind vane. Infrared LEDs and phototransistors are mounted on six orbits on each side of a 6-bit GRAY-coded disc. Turned by the vane, the disc creates changes in the code received by the phototransistors. The code

is changed in steps of 5.6°, one bit at a time to eliminate any ambiguities in the coding.

A heating element in the shaft tunnel keeps the bearings above freezing level in cold climates. Nominally, it provides 10 W of heating power. It is recommended to use a thermostat switch in the sensor cross arm for switching the heating power on below +4 °C.



0105-013

Figure 15 WAV151 Wind Vane

WAA252

The WAA252 Heated Anemometer is designed for environments where a non-freezing sensor is required. Foil heaters are inserted into each cup and in the cup wheel hub.

The transmission of heating power to the WAA252's rotor is contactless, with no slip rings or brushes. This feature eliminates sparks and excessive friction or wear. Power to the heaters is supplied via a rotary transformer, with 26 kHz low-EMI sine wave.

Power consumption, typically 72 watts, is very low considering the heating efficiency and the protection against freezing provided.

WAV252

The WAV252 Heated Wind Vane is a non-freezing sensor of novel design. Its lightweight vane offers excellent sensitivity and fast

response. The foil heaters integrated in the vane & tail assembly protect the gauge's rotating parts against, even in extreme climates.

The transmission of heating power to the WAV252's rotor is contactless, with no slip rings or brushes. This feature eliminates sparks and excessive friction or wear.

Power consumption, typically 50 watts, is very low considering the heating efficiency and the protection against freezing provided.

WAS425A/WAS425AH

Figure 16 WAS425A Ultrasonic Wind Sensor

WAS425A and WAS425AH Ultrasonic Wind Sensors determine wind speed and wind direction. The difference between these sensors is that model WAS425A is unheated, whereas model WAS425AH has a built-in heater. WAS425AH uses 36 VDC to power the heater elements. The elements have a built-in thermostat to switch the heaters on when the transducer head needs it. The ultrasonic wind sensor is shown in Figure 16 above. The joint sensor features are:

- Communication with a wide range of data acquisition systems using:
  - Digital output for RS-232 serial data interface
  - Analog outputs
- No moving parts
- Power-on self-tests of RAM and ROM
- Contamination and corrosion resistance since exposed surfaces are stainless steel and anodized aluminum
- Simple alignment to true north.

Air Temperature and Relative Humidity Sensor

Figure 17 QMH102 Temperature and Relative Humidity Sensor

The QMH102 probe is designed for the measurement of relative humidity and temperature. Humidity measurement is based on the capacitive thin film polymer sensor HUMICAP®180. Temperature measurement is based on resistive platinum sensors (Pt 100 and Pt 1000). Both the humidity and temperature sensors are located at the tip of the probe and in the standard version is protected by a membrane filter. The QMH102 temperature output is passive (resistive output Pt 100).

Pressure Sensor

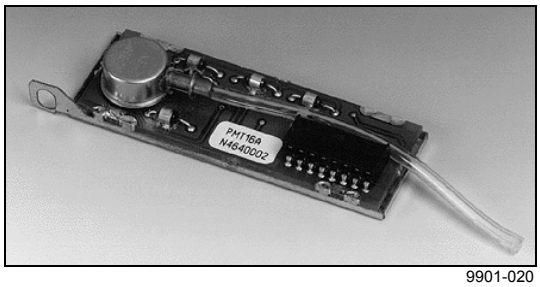


Figure 18 PMT16A Pressure Sensor

The silicon capacitive pressure sensor PMT16A has excellent accuracy, repeatability and long-term stability over a wide range of

operating temperatures. Therefore, it maintains its accuracy and calibration for long periods of time, thus reducing the need for field calibrations.

The fine adjustment and calibration of the sensor at the factory are handled according to the electronic working standards, which are based on international standards.

Precipitation Sensors

QMR102

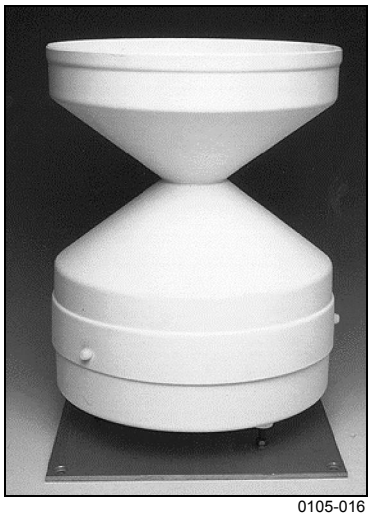


Figure 19 QMR102 Rain Gauge

An aerodynamically shaped rain gauge, Precipitation Sensor QMR102 is designed to minimize the wind-originated airflow reducing the catch. Manufactured from UV radiation resistant plastic, that makes it a very rugged instrument.

The collected rain is measured in a well-proven tipping bucket mechanism of 0.2 millimeters. QMR102 is installed on a stand or on a pedestal and it comes with a 6-meter cable and a connector.

RG13H

0105-017

Figure 20 RG13H Rain Gauge

The RG13H heated tipping bucket type rain gauge provides a well-proven and reliable method of monitoring rainfall also at temperatures below 0 °C. The gauge has a body and funnel of aluminum alloy, with an accurately machined septum-ring at the top to give an aperture of 400 cm^2. Bucket mechanism is mounted inside the body on a cast aluminum-alloy base incorporating fixing lugs, three leveling screws and a spirit level. The RG13H is equipped with integral heater. The heater switches on at temperatures below +4 °C. The heater power consumption is 38 W/40 VDC.

The rain gauge comprises a divided bucket assembly, which is pivoted at its center like a seesaw. Rain collects in the upper half of the bucket, which is adjusted to tilt when a predetermined amount of water has been collected. The tilting action discharges the collected water, and repositions the opposite half under the discharge nozzle ready for filling. The bucket tips are monitored by means of a magnet, which energizes a reed switch capable of a virtually indefinite amount of operations. This system ensures that the tipping bucket has a long, reliable working life.

DRD11A

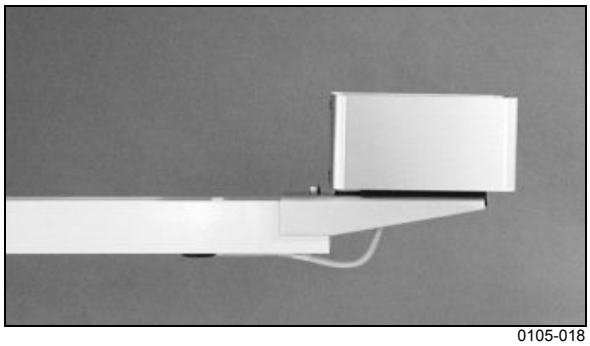


Figure 21 DRD11A Rain Detector

Rain and snow are detected quickly and accurately with the DRD11A Rain Detector. The DRD11A operates via droplet detection.

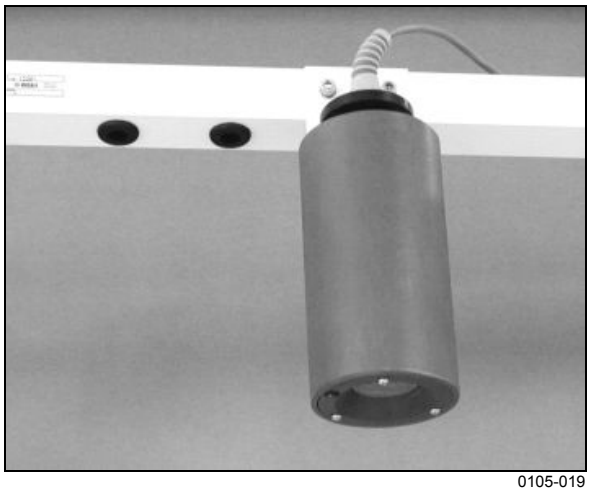
A special delay circuitry allows about two-minute interval between raindrops before assuming an OFF (no rain) position. This enables the sensor to accurately distinguish between rain cessation and light rain.

The DRD11A sensor is positioned at a 30° angle. This design, together with the internal heating element, ensures that the surface dries quickly, an essential factor in calculating intensity. The same heating element also protects the surface from fog and condensed moisture. In addition, the heating element is activated at low temperatures in order to melt snow, thus allowing snow detection. Sensor performance is not affected by reasonable amounts of dirt and dust due to droplet detection.

Due to the heating power requirements, DRD11A is recommended to be used only at stations equipped with AC power.

The DRD11A sensor set includes the sensor itself, cable, connector, small signal conditioner card, and installation accessories for the DKP12SUP1 sensor arm.

DCU7210



0105-019

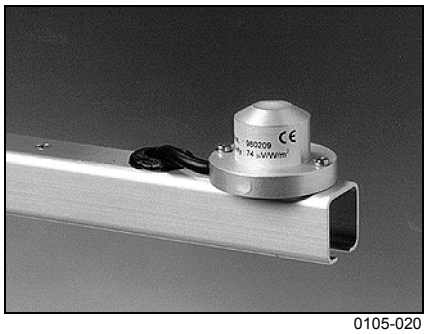
Figure 22 DCU7210 Snow Level Sensor

For measurement of snow levels, the DCU7210 Ultrasonic Snow Level Sensor features an electrostatic transducer in a protective case.

Traditionally, snow level measurement is achieved through physical measurements which are labor intensive and provide limited data. The DCU7210 sensor simplifies and improves this process by providing remote measurement of snow levels. When coupled with MAWS, snow level data can be recorded at regular time intervals providing good data at a minimum expense.

Solar Radiation Sensors

QMS101



0105-020

Figure 23 QMS101 Pyranometer

The QMS101 pyranometer is used for measuring global solar radiation. QMS101 uses a photodiode detector for creating a voltage output proportional to the incoming radiation. Due to the unique design of the diffuser, its sensitivity is proportional to the cosine of the angle of incidence of the radiation, thus allowing accurate and consistent measurements. QMS101 has a ready-made cable with a connector, and is easily installed on the sensor cross arm.

QMS102

Figure 24 QMS102 Pyranometer

QMS102 Pyranometer is an ISO/WMO-classified second class pyranometer. The precision optical glass dome acts as a filter, with a spectral band-pass that permits the full solar spectrum to pass through to the sensor. The sensor is a high-quality blackened thermopile with a flat spectral response. Heating of the sensor by incoming solar radiation produces a signal in the microvolt range.

CM6B

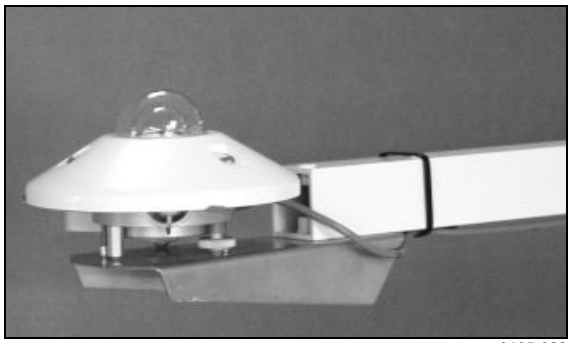


Figure 25 CM6B Pyranometer

CM6B Pyranometer is an ISO 9060 first class pyranometer. CM6B incorporates a 64-thermocouple sensor, which is rotationally symmetrical and housed under K5 glass domes. A white screen prevents the body of the pyranometer from heating up.

CM11

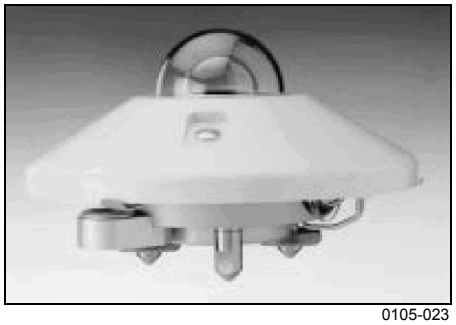


Figure 26 CM11 Pyranometer

CM11 Pyranometer is an ISO 9060 secondary standard pyranometer. CM11 incorporates a 100-thermocouple sensor, which is rotationally symmetrical and housed under K5 glass domes. A white screen prevents the body of the pyranometer from heating up.

QMN101

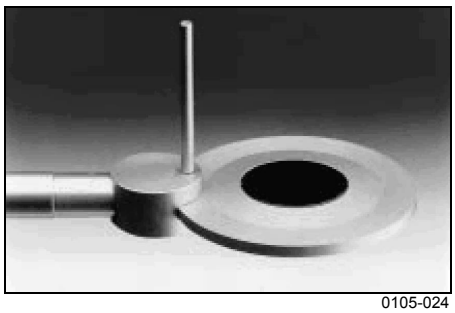


Figure 27 QMN101 Net Radiation Sensor

QMN101 Net Radiation Sensor is designed for routine measurements of net radiation. Net radiation is the balance between incoming and outgoing radiation in outdoor conditions. The sensor measures solar and far infra-red radiation balance.

The sensor is based on a thermopile and it consists of two Teflon-coated, weather-resistant black conical absorbers. The voltage output is proportional to the net radiation. Contrary to common instruments, QMN101 is virtually maintenance-free as it does not require fragile plastic domes.

DSU12

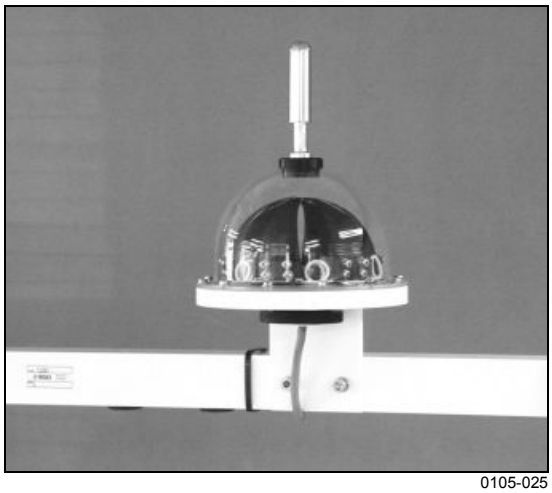


Figure 28 DSU12 Sunshine Duration Sensor

DSU12 Sunshine Duration Sensor provides a contact closure in response to direct solar radiation above its set point flux level. The total sunshine duration for any day is thus the sum of the contact closure times and is logged by MAWS processor.

DSU12 employs six blackened temperature sensitive bimetallic element pairs, arranged in a circle, which track each other thermally during overcast lighting conditions. When exposed to direct sunshine, the inner element is shaded whilst the outer element heats and bends to make a contact closure. In the absence of direct sunshine, the inner element receives diffuse radiation reflected from the white base and therefore the element pairs bend uniformly under varying temperature conditions thus preventing false contact closures.

The element pairs are protected within a clear acrylic dome fitted with a silicone O-ring seal and restricted ventilation chimney. Due to the difference in the bend radius of the inner and outer elements, the contacts close with a self-cleaning wiping motion.

Rain drops and frosting on the outer dome have negligible effect upon the performance of the DSU12 sensor. The solar heating of the dome via the blackened element pairs and the restricted ventilation combine to assist in quickly melting snow deposits and frost. Heavy snowfalls may reduce the effectiveness of operation.

DSU12 can be used at latitudes between 0° and 65° in either hemisphere. The sensor is correctly installed when exposed to the sun, without shading, throughout the entire day. Due to the shape and geometry of the element pairs, DSU12 does not need any special alignment for the latitude of the site or the season of the year. The instrument is equipped with a shielded 2-core cable, two meters in length, and a connector for easy installation.

Soil Temperature Sensors

QMT103

Figure 29 QMT103 Soil/Water Temperature Sensor

QMT103 Temperature Probe is particularly intended for precision measurement of ground and soil temperatures. All the materials have been carefully selected to withstand various environmental stress and wide temperature range. The measurement accuracy and stability of the temperature probe are based on a Pt-100 type sensor element specified to 1/4 DIN 43760B preciseness level. The probe includes a 5-meter cable with a black, weather-resistant polyurethane (PUR) sheath, which can tolerate both abrasive wear and extreme temperatures. Molded to the other end of the cable there is a 5-pin watertight connector, providing for instant assembly and replacement.

QMT107

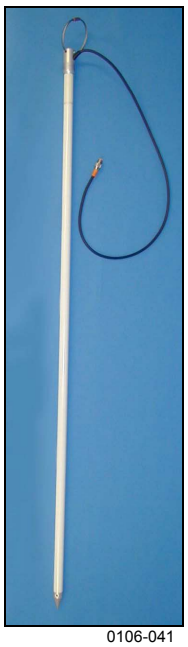
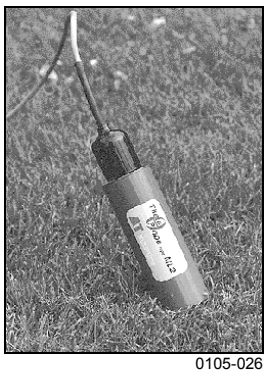


Figure 30 QMT107 Soil Temperature Sensor

The QMT107 probe is designed for the measurement of soil temperature and temperature profiles as a function of depth. Temperature measurement is based on resistive platinum sensors (Pt-100). There are seven temperature sensors located inside the probe. The sensors are positioned to +5 cm, ±0 cm, -5 cm, -10 cm, -20 cm, -50 cm, and -100 cm levels, where ±0 cm corresponds to the ground level mark of the probe.

The probe is constructed of glass fiber tube filled with epoxy, which makes the design watertight and provides low thermal conductivity. This ensures maximum accuracy as the sensor itself consumes very little power, thus causing almost no self-heating.

Soil Moisture Sensor



0105-026

Figure 31 ML2x Soil Moisture Sensor

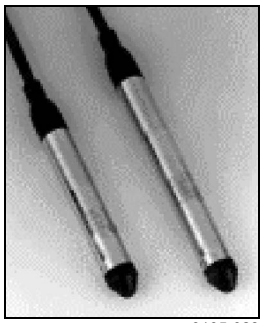
ML2x Soil Moisture Sensor features a new technique with the accuracy of ± 2 % soil moisture.

Traditional low cost sensors made of gypsum block dissolve even in a short period of time when exposed to high moisture. The ML2x sensors are very durable. The rods are 60 mm long, made of resilient, solid stainless steel, and can be unscrewed and replaced if necessary. All exposed materials are either stainless steel or durable plastic, and the probes are fully sealed. This way they can also safely be buried into the ground.

The ML2x probes offer high accuracy and extended lifetime in permanent or temporary measurements of soil moisture.

Water Level Sensors

QMV101



0105-028

Figure 32 QMV101 Water Level Sensor

QMV101 Water Level Sensor determines water level by measuring the water pressure above the submerged sensor in reservoirs, lakes, and rivers. The pressure measurement is based on high performance micro-machined silicon technology, packaged in a fully welded 316 stainless steel assembly.

The specific features include a Kevlar strain relieved vented cable, internal condensation protection and an IP68 injection molded cable assembly, which guarantees sensor operation over an extended period of time.

QMV102

Figure 33 QMV102 Water Level Sensor

QMV102 Water Level Sensor determines water level by measuring the water pressure above the submerged sensor in reservoirs, lakes, rivers, and offshore. This transducer incorporates the latest advances in depth and level measurements. The highly stable pressure measurement is based on silicon measurement element fully isolated from the media by a titanium isolation diagram. The use of titanium enables the sensors to be used in the most hostile of fluids where materials such as stainless steel cannot be considered.

QSE101

The QSE101 Incremental Shaft Encoder is a rugged and reliable sensor. It measures fluid levels, such as stream stage, when used with a pulley, tape, and float arrangement. Alternatively, you can measure position changes when the sensor is coupled to any rotating or translating mechanical system.

Figure 34 QSE101 Incremental Shaft Encoder

Magnetic encoder model QSE101 uses a 50-pole permanent magnet fixed to a shaft. As the shaft rotates, a pair of Hall Effect detectors mounted to a circuit board sense the change between the "off" and "on" states when the magnetic flux switches direction. Each Hall Effect detector outputs 50 counts per revolution, for a total of 100. The relative phase of the two pulses indicates the direction of rotation. The current level of the surface or position of the object being measured is found by adding the counts to the accumulated value for one direction of rotation and subtracting counts for the other direction.

There are no mechanical contacts or switches used in the measurement process. The only contacting moving parts in the sensor are the precision shaft bearings. The starting torque is low. The sensor is not sensitive to vibration. The housing is a black-anodized aluminum case for installation in exposed locations. It operates from –20°C to +55°C in relative humidity of up to 100%.

Serial data output connects the sensor to the serial data communication line configured to the SDI-12 standard. The SDI-12 line uses a single wire for data and is useful to a length of at least 60 meters.

DCU7110

Figure 35 DCU7110 Ultrasonic Water Level Sensor

An environmentally sealed housing and low current draw are combined in the DCU7110 Ultrasonic Water Level Sensor. DCU7110 is an excellent sensor for environmental monitoring applications. Typical applications are channel level measurement and stilling well level monitoring.

Leaf Wetness Sensor

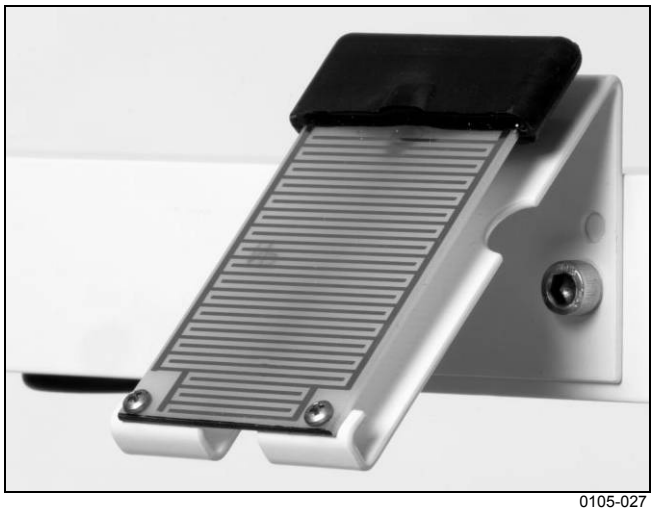
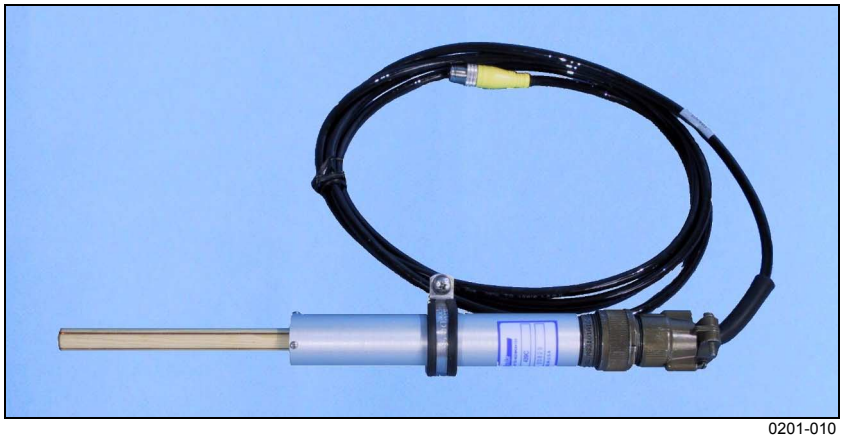


Figure 36 QLW101 Leaf Wetness Sensor

QLW101 Leaf Wetness Sensor enables MAWS to detect the presence of surface moisture on foliage and calculate the duration of wetness. When moisture is present, the sensor detects an electrical resistance change between the gold-plated elements of the grid.

Fuel Moisture Sensor

QFM101 Fuel Moisture Sensor measures the moisture content of the material on the forest floor or other natural area to help forest managers assess the fire danger. It uses a carefully selected and prepared pine dowel to exchange moisture with the environment. The sensor measures the moisture content of the dowel by its electrical capacitance.



0201-010

Figure 37 QFM101 Fuel Moisture Sensor

A thermistor, located in the dowel where it fastens to the base, measures the temperature of the dowel giving the estimated temperature on the forest floor. This measurement is available as a second input to the controlling data acquisition system.

Smart Sensors

CT25K

Figure 38 CT25K Ceilometer

The CT25K laser ceilometer is a new generation general purpose cloud height sensor. CT25 employs pulsed diode laser LIDAR (Light Detection and Ranging) technology for detection of clouds, precipitation and other obstructions to vision, and accurate determination of cloud heights and vertical visibility.

The standard measurement range of CT25K extends up to 25 000 feet (7.5 km) covering most heights where dense cloud appears. The instrument is capable of reporting up to three cloud layers simultaneously. It detects the cloud base reliably in fog, rain, snow, and haze. If the cloud base is obscured, CT25K measures and reports the vertical visibility.

Extensive internal monitoring is supported by a comprehensive set of user commands that can be given locally or remotely. The internal monitoring includes a sensor measuring the outgoing laser pulse energy, a circuitry checking the receiver sensitivity, a sensor monitoring window contamination and a sensor measuring the tilt angle. These and other internal measurements are used by the diagnostics software and the detection algorithm for maximum reliability and ease of use.

PWD11

Figure 39 PWD11 Present Weather Detector

PWD11 Present Weather Detector is an intelligent multivariable sensor for automatic weather observing systems. The sensor combines the functions of a forward scatter visibility meter and a present weather sensor. In addition, PWD11 can measure the intensity and amount of both liquid and solid precipitation.

PWD11 is suitable for weather observing systems providing valuable information, for example, to road and harbor authorities.

The versatility of PWD11 Present Weather Detector is achieved with a unique operating principle. PWD11 measures an estimate of the precipitation water content with a capacitive device and combines this information with optical scatter and temperature measurements. These three independent measurements together sufficiently provide data for an accurate evaluation of the prevailing visibility and weather type.

PWD21

The PWD21 is enhanced version from basic PWD11 Present Weather Detector with wider visibility measurement range and present weather measurement capabilities. PWD21 uses more sophisticated algorithm and signal processing than the basic version.

It is suitable for automatic weather station applications especially for low power requirement installations.

FD12

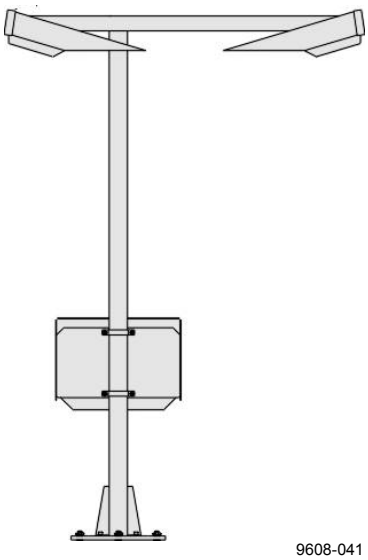


Figure 40 FD12 Visibility Sensor

The FD12 forward-scatter visibility sensor evaluates the Meteorological Optical Range (MOR) by measuring the scatter of infrared light in the air. Typical applications of FD12 are visibility measurement at airports and onboard ships, fog detection and warning for highways, and meteorological observations at remote locations.

FD12 consists of a transmitter, a receiver, and a controller. The simplified mechanical design means minimum disturbance to the sample volume of air. The compact construction and factory set mountings ensure easy installation and eliminate problems with startup adjustments.

FD12P

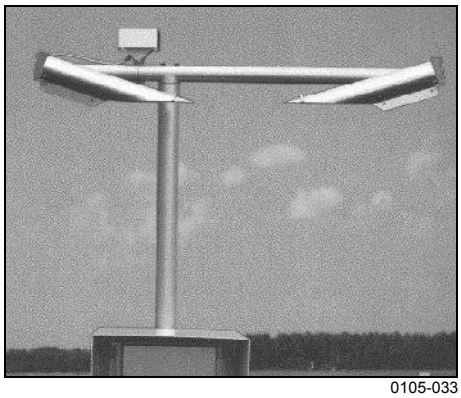


Figure 41 FD12P Present Weather Sensor

FD12P Present Weather Sensor is an intelligent multi-variable sensor that combines the functions of a forward scatter visibility sensor and a present weather sensor. In addition, FD12P can measure the intensity and amount of both liquid and solid precipitation.

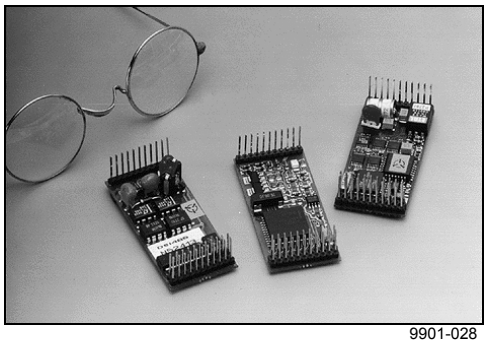
The versatility of FD12P Present Weather Sensor is achieved with a unique operating principle. FD12P measures precipitation water content with a capacitive device and combines this information with optical scatter and temperature measurements. These three independent measurements together provide sufficiently data for an accurate evaluation of prevailing visibility and weather type.

Communication Devices

Optionally, MAWS can be equipped with different types of communication equipment.

Communication Modules

MAWS has one RS-232 port as standard. Two optional plug-in modules can be used for enhancing the number of the serial I/O channels up to five.



9901-028

Figure 42 Communication Modules

DSU232

The DSU232 is an unisolated RS-232 module that will provide either a double serial channel without handshaking or a single RS-232 with handshaking. It has an ability to feed 12 V (45 mA) for serial sensors. The power consumption is less than 10 mA when communicating, less than 1 mA at standby.

DSI485A

DSI485A is an isolated communication module for providing the 2- or 4-wired RS-485-communication link between MAWS and another piece of equipment with a similar interface. The DSI485A module is used for example for connecting displays and terminals to MAWS when the distance is longer than 15 meters. The maximum distance for DSI485A is approx. 1500 meters at full speed. The power consumption is from 10 to 25 mA when communicating and 1 mA at standby.

The DSI485A module must be configured before using it so that it works as desired. The Lizard Setup Software is used for this purpose.

DSI486

DSI486 is a dual isolated communication module, which can be used in various modes, RS-232, RS-485, or SDI-12. Communication mode is selected by the correct wiring of the I/O pins and with the correct jumper settings on the board. The DSI486 module is used e.g. for connecting displays and terminals to MAWS when the distance is longer than 15 meters. The maximum distance for DSI486 is approximately 1500 meters at full speed.

The RS-485/422 channels A and B are galvanically isolated from the host board's electronics. The +5 VDC power supplies of channels A and B are also isolated from each other with capacitors. Thus, it is possible to wire these two channels to separate locations.

The RS-232 mode is utilizing channel B. While channel B is used in the RS-232 mode, it is possible to use channel A as a galvanically isolated two-wire RS-485 channel. The RS-232 channel is galvanically connected to the host board's GND potential.

The SDI-12 channel has an own connecting point on the board. It is not using channel A or B for the communication. SDI-12 is galvanically connected to the host board's GND potential.

The DSI486 module must be configured before using it so that it works as desired. The Lizard Setup Software is used for this purpose.

Modem DMX501

The DMX501 communication module is used for providing long distance fixed line connection between MAWS and another Vaisala

equipment with a similar interface, max. distance up to 10 km. Through this I/O port, MAWS can send reports and data or the host can poll them.

The DMX501 modem module supports the following communication standards:

- V.21, 300 bps FSK
- V.23, 1200 / 75 bps FSK
- V.22, 1200 bps DPSK

The DMX501 modem module must be configured before using it so that it works as desired. The Lizard Setup Software is used for this purpose.

Satellite Transmitters

ORBCOMM Satellite Transmitter

0105-034

Figure 43 QRB101 Attached to the Enclosure Door

Vaisala has integrated the satellite communication media called ORBCOMM with the MAWS systems. The QRB101 ORBCOMM system uses Low-Earth-Orbiting (LEO) satellite, enabling the use of low power and small antenna in the transmitter terminals.

The QRB101 ORBCOMM system with a built-in GPS receiver is installed inside the BOX501 enclosure.

The ORBCOMM transmitters offer a low cost and robust way of transmitting data from remote sites almost in real-time. There is no need to install costly direct ground receiving stations. The local ORBCOMM operators offer the service where the data is transmitted to the users via Internet or dedicated lines directly from their Gateway Earth Stations.

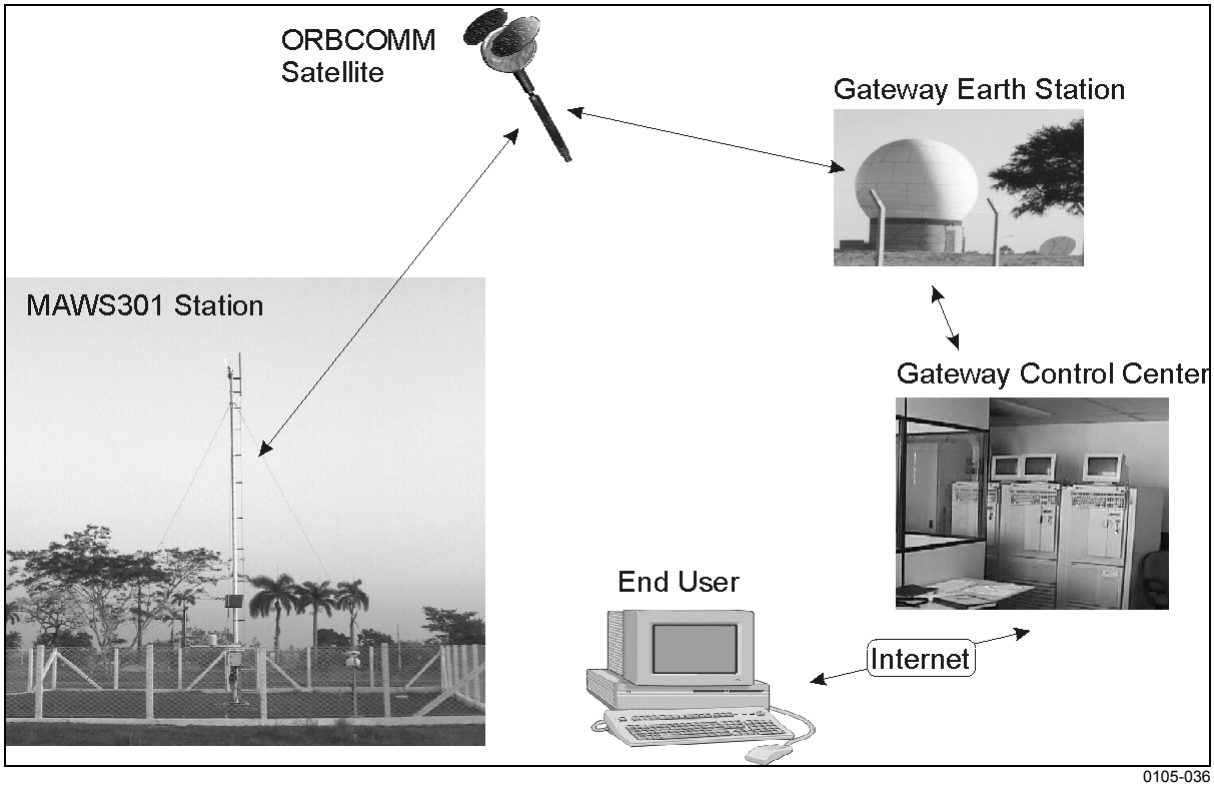
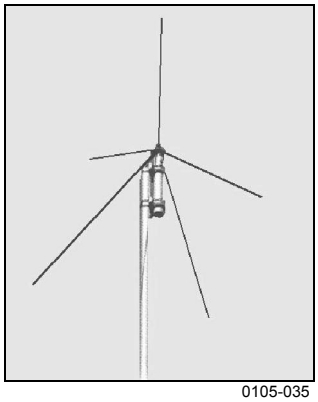


Figure 44 MAWS301 with ORBCOMM

Alternatively, the antenna can be a standard whip antenna shown in Figure 45 on page 56.



0105-035

Figure 45 Antenna for ORBCOMM Satellite Transmitter

All satellite transmitters are provided with the necessary cables, antenna, coaxial surge arrester for RF-signal and all mounting hardware.

GOES Satellite Transmitter Interface

This component provides serial interface to GOES satellite transmitter. GOES HDR300 (QST101) without the internal GPS provides transmission speed of 100 or 300 baud.

0202-004

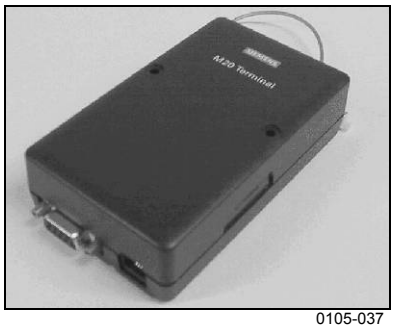
Figure 46 GOES Satellite Transmitter

The channel and data rate are programmable and can be changed as often as each transmission. The transmitter can be set to any of the allowable 199 USA GOES channels (100 and 300 bps) or any 33 International Channels (100 bps).

The satellite transmitter is provided with the necessary cables, antenna, coaxial surge arrester for RF-signal and all mounting hardware.

Modems

GSM Data Modem

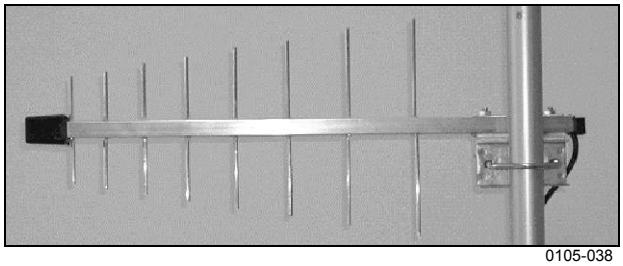


0105-037

Figure 47 GSMM20T GSM Data Modem

The GSMM20T GSM Data Modem has been especially designed for demanding professional use. In addition to working as a data modem, it supports GSM-SMS also. The data modem features small size, low power consumption with stand-by mode, and an extended operational temperature range from -20 to +55 °C. The GSM package includes all the necessary RF- and data cables, and installation accessories for both the terminal and the antenna.

The GSM antenna that is used with the GSM data modem is a directional antenna. The antenna provides high gain, enabling the data communication even in remote and sparsely populated installation sites where long distances or the terrain causes uncertain connections.



0105-038

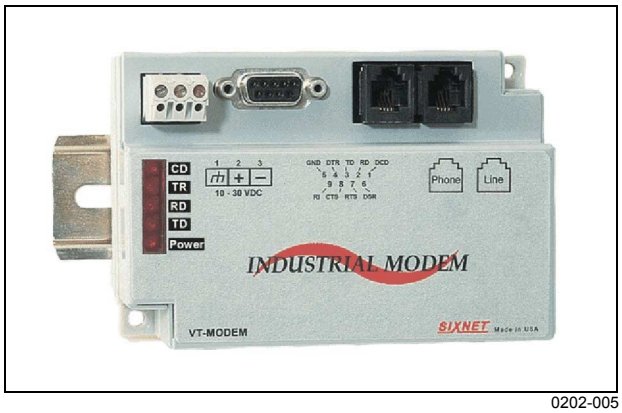
Figure 48 GSM Antenna

In addition to giving a good connection, a strong signal also reduces the power consumption at the station.

QMMODEM

VT-MODEM from SIXNET is an industrial hardened modem designed for demanding environments. It is rated for -30 to +70 °C

operating temperatures. The modem is mounted on the door of the BOX501. The modem is DC-powered and interfaced via RS-232 with the MAWS station.



0202-005

Figure 49 The SIXNET's Industrial Modem

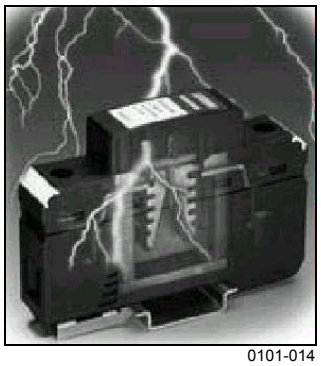
Optional Communication Equipment

Optionally, MAWS301 can be equipped with different types of communication equipment such as:

- UHF radio modems
- Other satellite transmitters.

Accessories

Surge Arrester



0101-014

Figure 50 Surge Arrester

A circuit works at the designated voltage without disturbance. A damaging voltage is any voltage increase, which leads to an exceeding of the tolerance threshold of the nominal voltage. This includes transient surge voltages arising as a result of switching operations and lightning discharge and inductive, galvanic or capacitive coupling in an electric system. Transient surge voltages have a very quick rise times of a few µs and relatively slow decay times ranging from several 10 µs to several 100 µs.

Damage caused by surge voltage can be avoided by very quickly short-circuiting the conductors. For example, when high voltages occur with the equipotential bonding, but only for the moment in which the surge voltage is present.

Handheld Terminal

Figure 51 QMD101 Handheld Terminal

QMD101 is a lightweight, rugged and easy-to-read handheld display device for viewing measured and calculated parameters and systems alarms, as well as for setting station-specific parameters.

GPS Time Synchronizing Unit

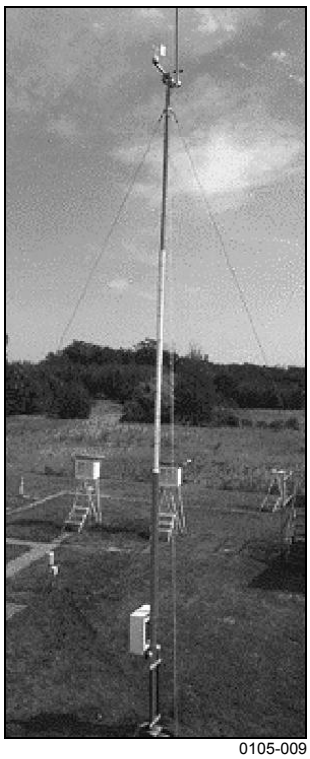
0105-113

Figure 52 QMG101 GPS Time Synchronizing Unit

QMG101 GPS Time Synchronizing Unit is a GPS receiver with an embedded antenna for accurate time synchronization. The unit is usually installed on sensor support arm and interfaced via RS-232 with a weather station. QMG101 comes with a 3 m cable, a connector, and installation accessories.

Installation Accessories

Masts



0105-009

Figure 53 Installation Mast with Accessories

DKP12

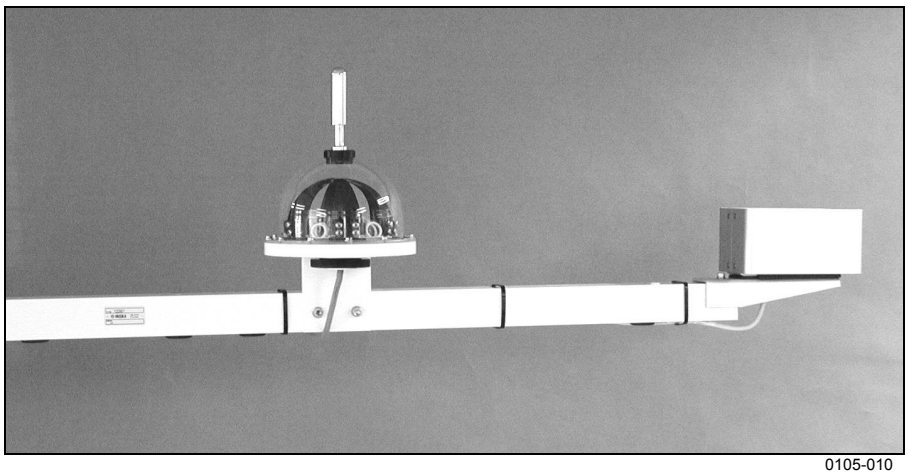
DKP12 is a 10-meter pole mast used for equipment installation. The mast is made of anodized aluminum resisting well even the most harsh weather condition. The mast is equipped with a lightning rod and a set of guy wires. The mast base and the guy wires require a solid concrete base.

The recommended grounding resistance is less than 10 ohms.

DKP15W

DKP15W is a 3-meter pole mast mainly designed for installing the WAA and WAV wind sensors together with WT521 wind sensor cross arm /transmitter. In addition, BOX501 enclosure and the sensor support arms can be easily installed on the mast.

Support Arms



0105-010

Figure 54 DSU12 and DRD11A Sensors Installed on Support Arm

Usually sensors are installed on a sensor cross arm (DKP12SUP1 or DKP12SUP2) at the height of 1.5 to 2.0 meters from the ground.

Connector Adapters

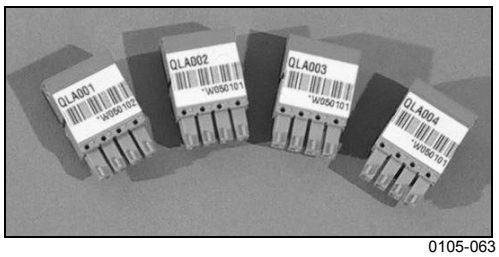


Figure 55 Connector Adapters

With some sensors, you have to install a connector adapter between the logger and the cable connector. The sensor specific connector adapters are listed in Table 8 below.

Table 8 Sensor Specific Connector Adapters

Connector Adapter	Sensor(s)
QLA001	QLW101 Leaf Wetness Sensor
QLA002	DRD11A Rain Indication Sensor
QLA003	DSU12 Sunshine Duration Sensor
QLA004	DCU7110 Water Level Sensor DCU7210 Snow Level Sensor
QLA005	QFM101 Fuel Moisture Sensor

WT521 Digital Wind Transmitter

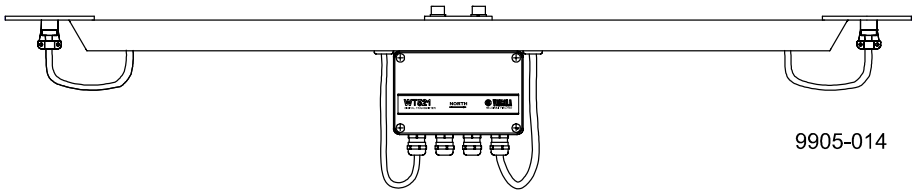


Figure 56 WT521 Digital Wind Transmitter

The WT521 Digital Wind Transmitter assembly includes a cross arm for easy mounting of Vaisala WAA- and WAV-series wind sensors. A digital transmitter is inside the junction box with four glands.

WT521 provides power control for shaft heated sensors. One of the glands is reserved for the heating cable from a local heating / operating power supply.

WHP25 Power Supply

0105-014

Figure 57 WHP25 Power Supply

WHP25 is a compact Mains Power Supply Unit intended for outdoor use.

The nominal input power of 230 VAC can be changed by jumpers between 100 VAC to 245 VAC (±10 %). There are two power outputs, namely 24.0 VDC (max 5.2 A) and 38.0 VAC (max 0.9 A).

The WHP25 outdoor power supply is capable of delivering power to the whole Heated Wind Sensor System and additionally, for example, to the RG13H Heated Rain Gauge.

WHP25 has a waterproof housing made from cast aluminum, mountable to a Ø 100 mm standard pole mast with a mounting hardware included in the delivery.

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CHAPTER 3

SELECTING LOCATION

This chapter provides information for locating the weather station and its sensors.

Finding a suitable site for the MAWS weather station is important for getting representative ambient measurements. Normally, the suitable site should represent the general area of interest. When locating the weather station, consider the items presented in the following sections. The descriptions are not exhaustive, for further information refer to local and WMO recommendations.

Wind Measurement

Allow sufficient clearance for the wind sensors. Wind sensors should not be located next to a building or any other object that might affect the airflow.

In general, any object of height (h) will not remarkably disturb the wind measurement at a minimum distance of $10 \times h$. For example, locate the weather station at least 30 meters away from a 3-meter high tree, see Figure 58 on page 66.

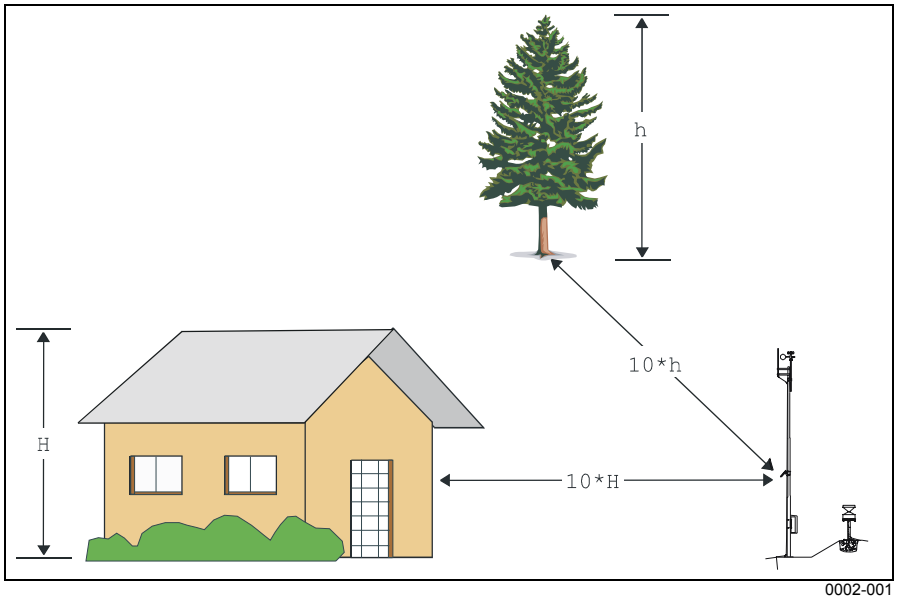

Figure 58 Siting the Station

Air Temperature and Relative Humidity

NOTE	The radiation shield is important in protecting the sensor from direct sunlight and must always be used.

For mast installations, the height of the sensor should be set to 1.5 to 2 meters. In the northern hemisphere, the sensor should usually be placed on the northern side of the tower. Avoid the following installation sites to ensure correct measurements: shaded areas, steep slopes, heat sources, swamps, high vegetation and places that might hold water after rains.

Precipitation

Rain gauge is installed on the ground, on a base plate, or on a separate stand near the MAWS enclosure.

The orifice of the gauge must be in a horizontal plane, open to the sky, and above the level of in-splashing and snow accumulation. In general, objects should not be closer to the gauge than a distance twice their height above the gauge orifice.

In areas of homogeneous dense vegetation, the height of the vegetation should be kept below the gauge orifice level by regular clipping. Sites on a slope or on the roof of a building should be avoided. Also hard flat surfaces such as concrete should be avoided to prevent excessive in splashing.

Solar Radiation

Make sure that no building or object will shadow the station, especially the solar panel and solar radiation sensors, during the day.

On the Northern Hemisphere, the solar radiation sensors should be installed on the southern side of the MAWS (on the Southern Hemisphere, vice versa) to avoid other weather station structures shading the sensor. To facilitate leveling/cleaning, installing at a height of 3 m or less is recommended.

The solar panel should face south (true south, not magnetic) on the Northern Hemisphere and north on the Southern Hemisphere.

Soil Temperature

Finding a suitable site for QMT103 or QMT107 Soil Temperature Probe is important for getting representative soil temperature measurements. Measurement site should be 1 m² and typical of the surface of interest. The ground surface should be level with respect to the immediate (10 m radius) area.

The QMT107 probes are pressed into pre-formed holes, but they can also be placed into excavated holes that are then filled. On hard or rocky ground, a pilot hole is pre-formed with an auger rod.

Soil Moisture

The soil water content measured by the ML2x sensor within one small locality can be affected by:

- Variations in soil density and composition
- Stones close to the rods
- Roots (either nearby or pierced by the rods)
- Earth worm holes or mole holes

- Subsoil drainage
- Small scale variability in transpiration and evaporation losses.

It is important to take the degree of variability of these parameters into account when deciding on the number of probes to be used at any particular location. If the soil is known to be very heterogeneous, it will be necessary to take measurements from at least three closely-spaced locations.

Water Level

Placement of QMV101/QMV102

Place the sensor according to the following examples. Refer to Figure 59 below.

Example 1: Average water level is 25 meters and maximum annual change is 50 cm. Suitable sensor is with range of 75 cm and installation place is 24,6 meter from ground level.

Example 2: In dry season the riverbed is dry and in rain season the ultimate water level is 7 meters. Suitable sensor would be with 10-meter range. If interested values start after water level is greater than 3 meters, it is possible to use 5-meter version and install it to 3 meters from ground.

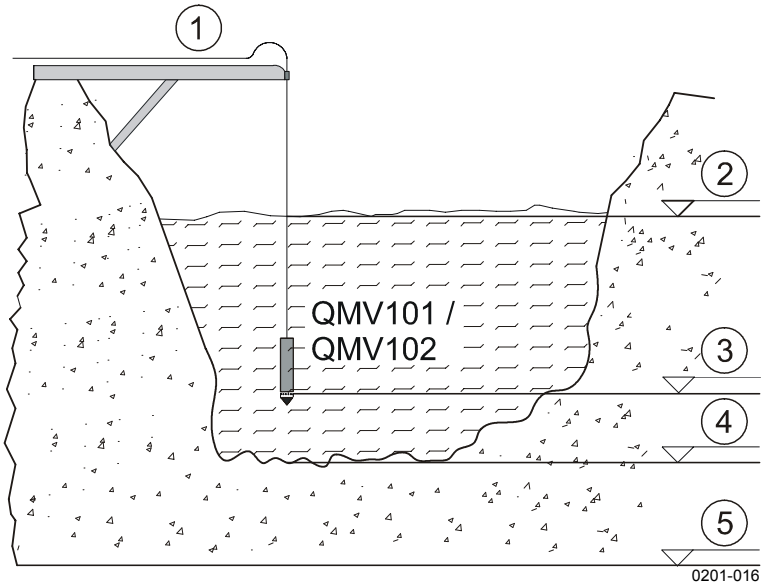

Figure 59 QMV102 (QMV101) Sensor in Water

The following numbers refer to Figure 59 on page 68:

1 = Cable to MAWS
2 = Water level
3 = Sensor level
4 = Local reference
5 = Common level

Typically, the water level sensor is installed in a stilling well or inside a pipe for protecting the sensor against debris and vandalism.

Placement of DCU7110

Place the sensor according to the Figure 60 below. The water level is then calculated from the formula:

h1 = H - h2

where

H = Offset to common level
h2 = Measured distance

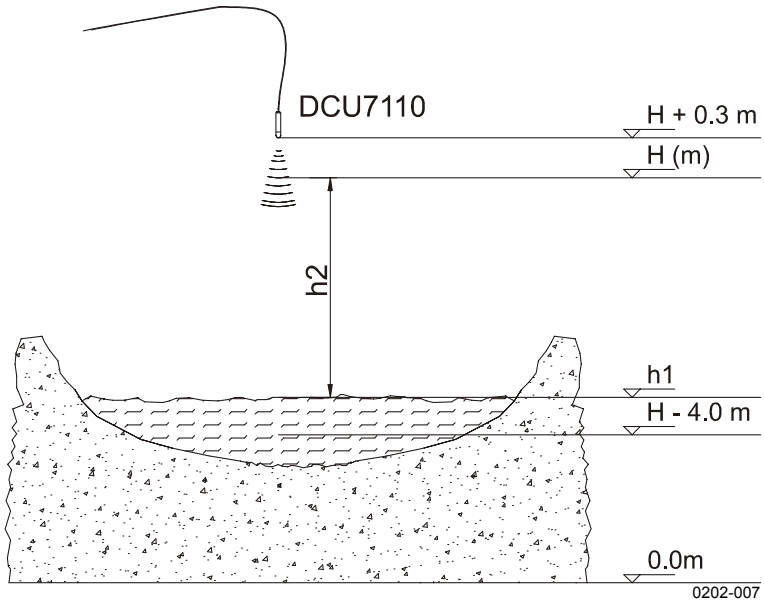

Figure 60 DCU7110 Placement over Water

Snow Level

The DCU7210 Snow Level Sensor should be located in an area where snow will not be disturbed and drifting is not likely to occur. The measurement area should be sheltered from the wind as much as possible. The best sites are often found in clearings within forests or orchards, among trees, in scrub or shrub forests, or where other objects act as an effective wind-break for winds from all directions.

Fuel Moisture

QFM101 Fuel Moisture Sensor can monitor the moisture conditions on the forest floor only if it can absorb and give up moisture near a fair sample of the material that is naturally present. It must exchange moisture with the air in essentially the same way that the forest floor materials do.

Mount the sensor on the south side of the tower (or the north side in the southern hemisphere) so that it is not shadowed by the tower. If possible, arrange that the sensor is exposed to sunlight for at least six hours in the middle of the day. Make sure that no grass or other vegetation touches the sensor; these can transfer moisture directly. The sensor must be installed approximately one week before it can give an accurate reading of the fuel moisture on the forest floor.

Weather Sensor

FD12P should be located in a way that the site has a minimum clearance of 100 m from all large buildings and other constructions that generate heat and/or obstruct precipitation droplets. Shade from trees may effect the microclimate and should therefore be avoided.

The site should be free of obstacles and reflective surfaces disturbing the optical measurement, as well as obvious sources of contamination.

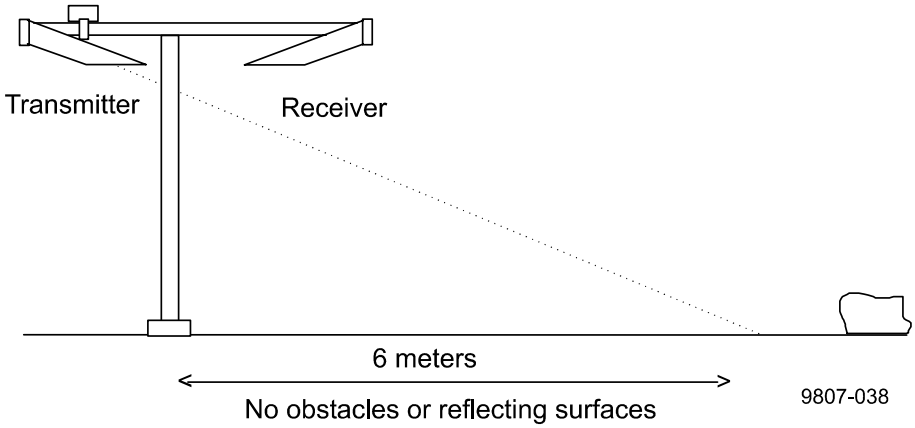

Figure 61 Recommended Location of FD12P

The receiver and transmitter optics should not point towards powerful light sources or, in bright daylight, towards reflective surfaces such as snow or sand. It is recommended that the receiver points north in the northern hemisphere and south in the southern hemisphere.

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CHAPTER 4

INSTALLATION

This chapter provides you with information that is intended to help installing MAWS and its sensors.

Preparing Installation

Make sure you have all the necessary tools at hand.

Tools needed:

- Compass or other method to establish the right orientation of the station
- Spirit level to make sure the sensor arm is level
- Screwdrivers
- Hex wrenches
- Laptop computer to make station dependent settings

Additional special tools for the different sensors are provided in their packages.

Unpacking Instructions

When you have received the delivery, check the sensors and see that you have all the ordered components. Make sure that they have not been damaged during transportation.

The manuals and special tools included in the packages should be stored in a safe place for later use.

Installation Procedure

Assemble the MAWS station according to the following procedure:

1. Assemble the tower.
2. Mount the sensor arm(s).
3. Mount the equipment enclosure.
4. Mount the solar panel.
5. Mount the wind sensor mast.
6. Mount the sensors.
7. Connect the internal battery (not in all configurations).
8. Connect cables to BOX501 connectors.

Mounting the Sensor Arms

Mount the sensor arm to the tower using the two bolts. The correct height for the sensor arm is 1.5 to 2 meters. Use a spirit level to verify that the arm is level. See Figure 62 below for more information.

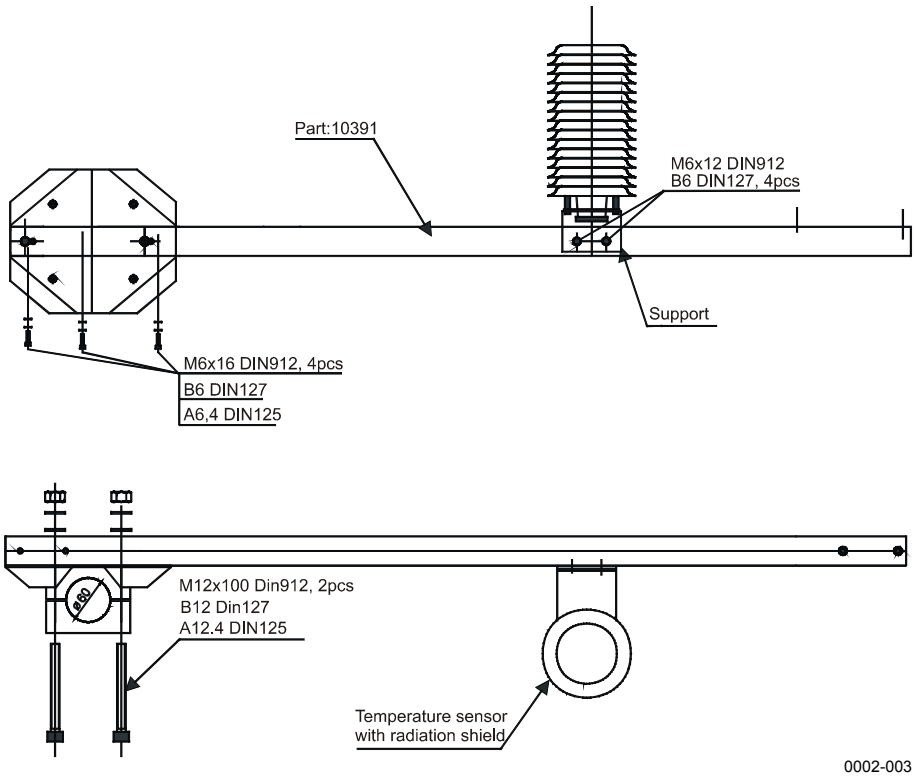


Figure 62 Mounting the Sensor Arm

Mounting the Equipment Enclosure

The BOX501 enclosure houses the MAWS data logger, battery regulator, backup battery, and optional powering as well as communication devices.

Two attachment brackets should be assembled on the rear of the enclosure. The attachment brackets are intended for mounting the enclosure to the mast of ∅ 100 mm. Correct installation height is approximately 1.5 ... 1.7 m (eye height for the best working access). The rear view of the enclosure is shown in Figure 63 below.

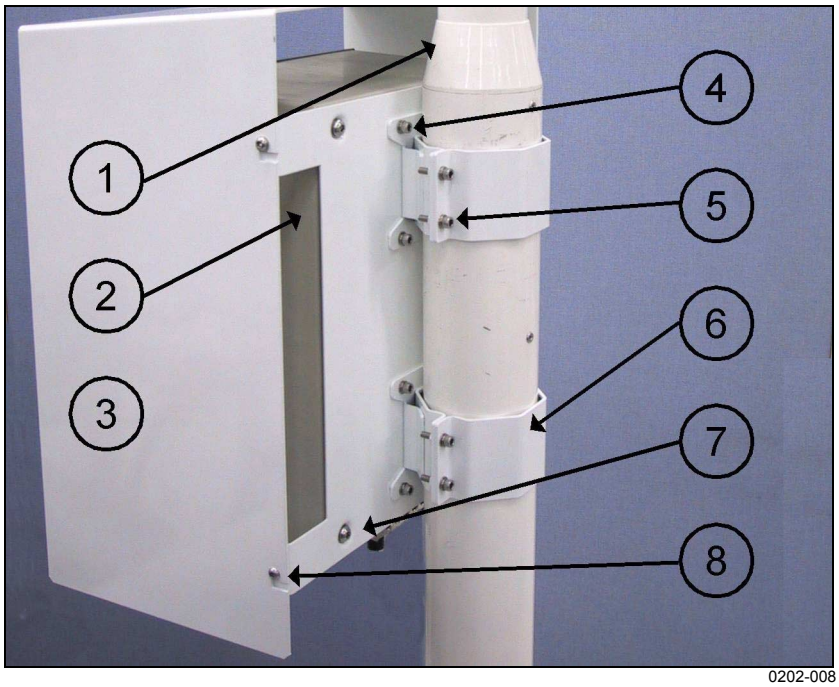


Figure 63 Mounting the Equipment Enclosure

The following numbers refer to Figure 63 above.

1 = The pole mast
2 = The equipment enclosure
3 = The radiation shield
4 = Eight installation bolts for attaching the bracket to the plate
5 = Eight installation bolts for assembling the bracket to the mast
6 = Two attachment brackets
7 = Four installation screws for attaching the plate to the enclosure
8 = Four installation screws for attaching the radiation shield to the plate

Installing Solar Panel

Mount the panel to the tower using the fasteners. The correct height for installation is approximately 4 m. Guide the cable down along the mast, keeping it away from the grounding cable.

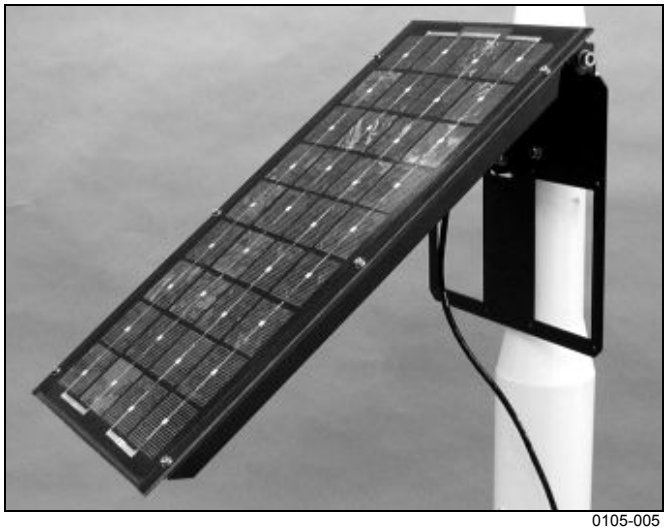


Figure 64 Solar Panel Attached to the Mast

The panel should face south (true south, not magnetic) in the northern hemisphere and north in the southern hemisphere. The panel can be tilted towards the sun: the further you are from the equator the more vertical the panel.

To maximize the annual energy output, install the panel at an angle explained in Table 9 below. At some installations, it may be effective to adjust the tilt seasonally. At most latitudes, performance can be improved during summer by using an angle smaller than the table's recommendation. Conversely, a larger angle can improve winter performance.

NOTE The rays of the sun should be perpendicular to the panel, which means sunlight should hit the panel at a 90° angle.

Table 9 Recommended Tilt Angle for Solar Panel

Latitude of site	Tilt angle
0 ... 4°	10°
5 ... 20°	Add 5° to local latitude
21 ... 45°	Add 10° to local latitude
46 ... 65°	Add 15° to local latitude
65 ... 75°	80°

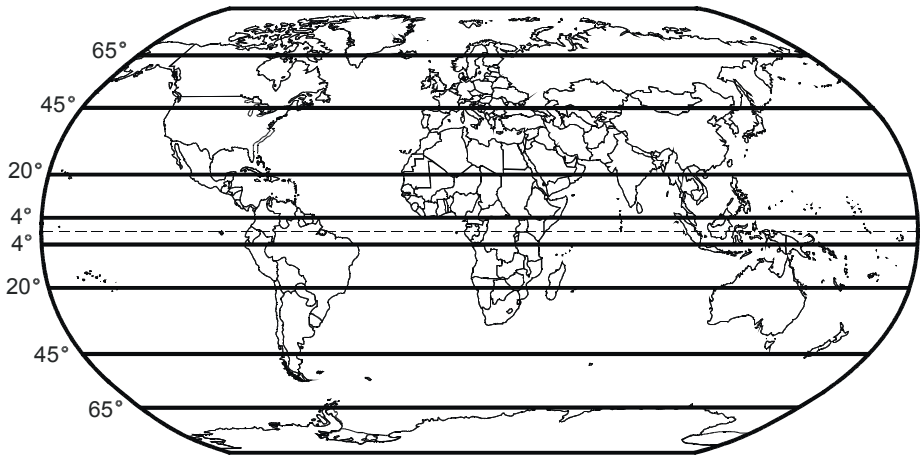


Figure 65 Map of Latitudes

WARNING	Photovoltaic modules generate direct current (DC) when exposed to sunlight or other sources of light. Although single modules produce low voltage and current, shocks and burns can still result from contact with module output wiring. PV modules do not have to be "connected" (i.e., powering a load) to generate electricity. Since modules produce electricity whenever light is preset, the module should be completely covered by an opaque cloth or other material before electrical connections to the modules or other system components are handled.

CAUTION	Handle with care: impact on the front or rear surface can damage the module. Do not bend the panel.

CAUTION	When working with panel, use properly insulated tools and wear rubber gloves.

NOTE	Do not concentrate light on the panel in an attempt to increase its power output.

Installing Sensors

Wind Sensors

Before installing the sensor itself, you have to mount the wind sensor mast to the sensor mast. After you have installed the mast, you can mount the wind sensor on top of it.

QMW110A

After you have unpacked the sensor, please, check for any signs of shipping damage. Make sure that the vane and cup wheel rotate without friction. For the connector pins, see Figure 66 below.

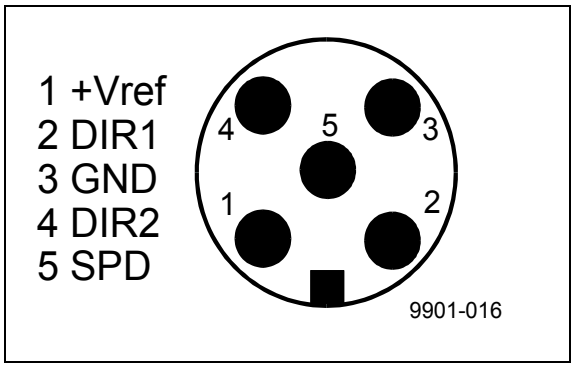


Figure 66 Connector Pins of QMW110A

After initial installation, the sensor can be removed and reattached using the plastic collar without realigning, except after potentiometer replacement.

Installation procedure (numbers in parenthesis refer to Figure 67 on page 79):

1. Connect the wind sensor cable to the sensor.
2. Place the mounting piece (2) on top of the mast and attach the sensor to the mounting piece with the plastic collar (3).
3. Secure the mounting piece to the mast by tightening the mounting screw (4).

WARNING	Do not install the wind sensor above the lightning protection rod.

4. Guide the sensor cable down along the mast to the enclosure.

5. Connect the signal cable to MAWS (see section Connecting Cables on page 129).

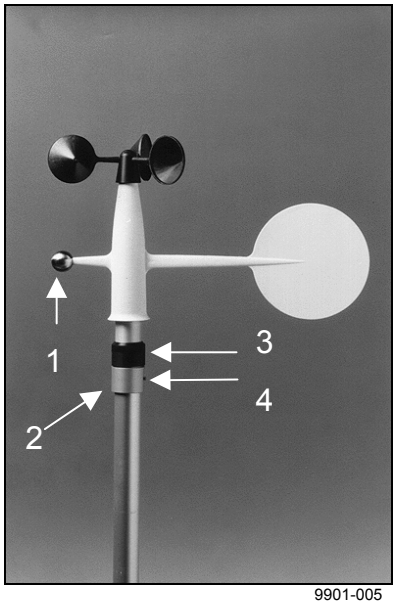


Figure 67 Mounting the Wind Sensor

After mounting the sensor, you have to align the wind vane:

1. Turn the nose (number 1 on Figure 67 above) of the vane to a known point of compass (e.g. north).
2. Give command **winddircal0** with the known direction reading (e.g. **winddircal0 360**. This will set the current direction to the north, 360 degrees).

WT521

The cables from the sensors are already connected to the WT521 transmitter by the manufacturer.

When installing the equipment for example in tropical, marine, or cold temperature environments it is important to note that the equipment is kept within its specific operating conditions. The cables must be terminated properly by tightening the cable glands to avoid dust, dirt or water to enter the equipment.

WARNING	A long cable between different units (sensors, transmitters, power supplies, and displays) can cause a lethal surge voltage, if a lightning strike occurs in the vicinity. Always ground the mast equipment case close to the mast with a short and low-resistance cable.

WT521 including a cross arm for WA-series sensors is mounted to the top of a standard 60 mm pole mast.

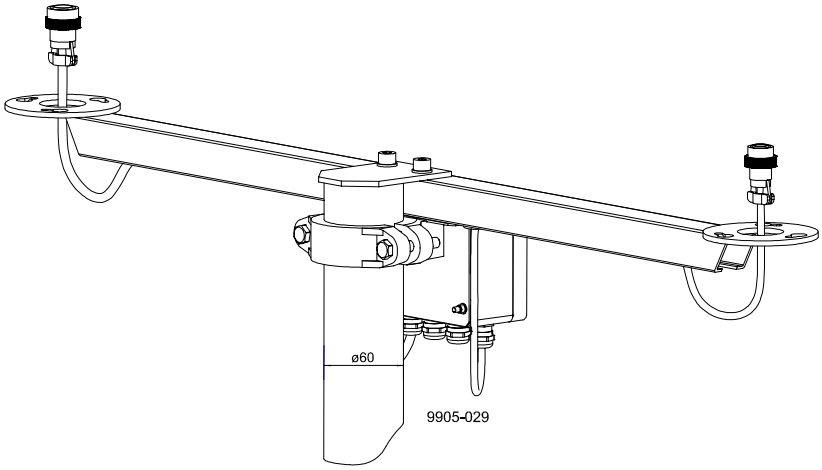


Figure 68 Mounting WT521 to the Top of a Pole Mast

A good shielding is essential for quality data transmission and low electromagnetic interference. Figure 69 below illustrates how to use shielded cable with the WT521 transmitter cable glands.

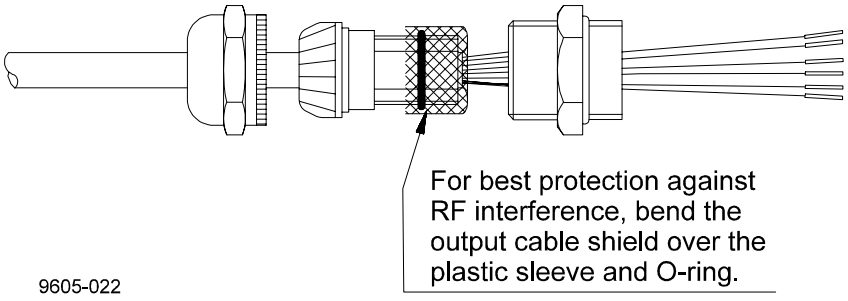


Figure 69 Using Shielded Cable with WT521 Glands

It is recommended to ground a mast equipment with a grounding cable as short as possible. The quality of this cable is to be checked with a georesistance meter. The grounding resistance must be less than 10 Ω.

An example of the wiring diagram is shown in Figure 70 on page 81. It uses RS-232 for communication between the logger and WT521. For more information on connecting other interfaces or optional heating for the sensors, refer to WT521 User's Guide.

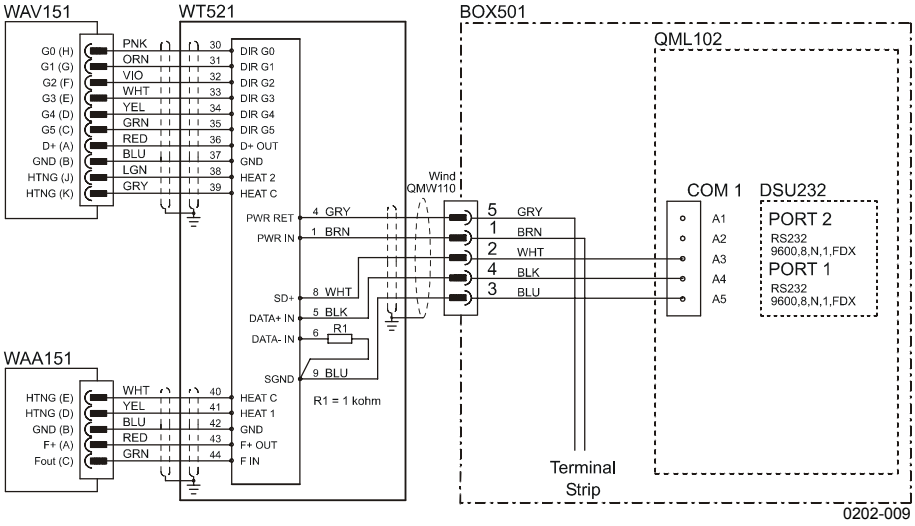


Figure 70 Wiring Diagram for WT521 Using RS-232

WAA151

Mount WAA151 to the southern end of the cross arm.

1. Remove the cup assembly to make the installation safer.
2. Fit the 6-pin cable plug through the mounting flange at the end of the cross arm, then connect it to the sensor.
3. Mount the sensor to the flange by twisting, and tighten the screws.
4. Mount the cup assembly and tighten its screw.

WAV151

Mount WAV151 to the northern end of the cross arm.

1. Remove the tail to make the installation safer.
2. Fit the 10-pin cable plug through the mounting flange at the end of the cross arm, then connect it to the sensor.
3. Mount the sensor to the flange by twisting, and tighten the screws.
4. Mount the vane assembly and tighten its screw.

WAA252

Before installing the WAA252 Heated Anemometer, check that it has not been damaged during transportation. Also, check that the shaft rotates smoothly without any detectable noise.

Mount WAA252 to the southern end of the cross arm.

1. Remove the cup assembly to make the installation safer. Be careful not to cause damage to the shaft of the sensor body or to the connector pins.
2. Pre-assemble the three mounting screws, with plastic washers, to the anemometer's mounting legs.
3. Fit the 6-pin cable plug through the mounting flange at the end of the cross arm, then connect it to the sensor.
4. Mount the sensor to the flange by twisting, and tighten the screws. On the bottom of the WAA252 there is a special button-shaped temperature sensor (diameter 22 mm), elastically attached to the bottom plate. This is for sensing the ambient temperature and should therefore be set in good thermal contact with the mounting support.
5. Mount the cup assembly. Align the planes in the shaft and inside the hub. The bottom edges of the hub and the shoulder should reach approximately the same level (see Figure 71 below). Tighten the set screw.

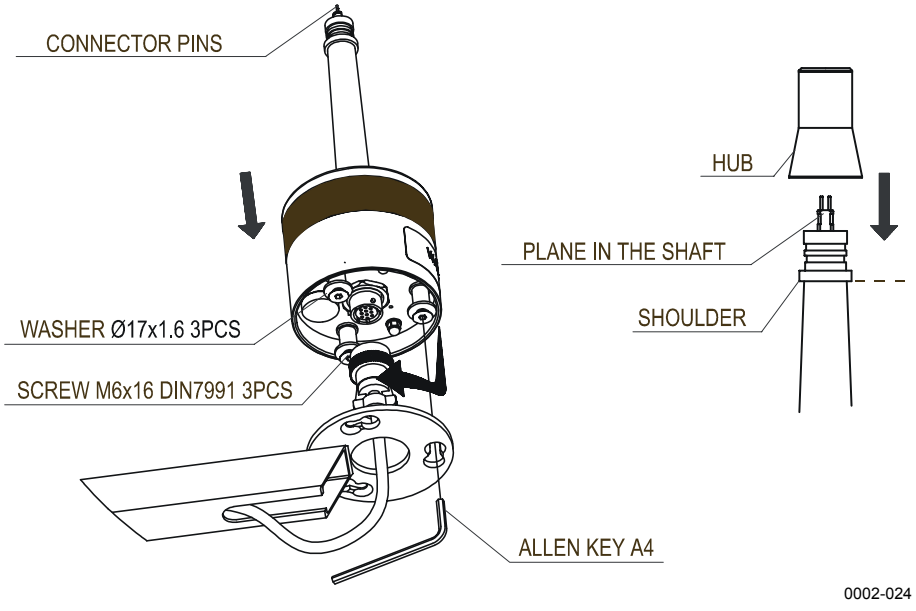


Figure 71 Mounting of the Wind Sensor and the Hub

WAV252

Before installing the WAV252 Heated Wind Vane, check that it is not damaged during transportation. Check also that the shaft rotates smoothly without any detectable noise.

Mount WAV252 to the northern end of the cross arm.

1. Remove the vane to make the installation safer. Be careful not to cause damage to the shaft of the sensor body or to the connector pins.
2. Pre-assemble the three mounting screws, with plastic washers, to the anemometer's mounting legs.
3. Fit the 10-pin cable plug through the mounting flange at the end of the cross arm, then connect it to the sensor.
4. Mount the sensor to the flange by twisting, and tighten the screws. On the bottom of the WAV252 there is a special button-shaped temperature sensor (diameter 22 mm), elastically attached to the bottom plate. This is for sensing the ambient temperature and should therefore be set in good thermal contact with the mounting support.
5. Mount the vane. Align the planes in the shaft and inside the hub. The bottom edges of the hub and the shoulder should reach approximately the same level (see Figure 71 on page 82). Tighten the set screw.

WHP25

WHP25 Power Supply can be installed to a Ø 100 mm pole mast, with the standard mounting clamp. To install WHP25, follow the procedure below:

1. Remove the four screws attaching the cover of the WHP25 unit. Remove the cover.
2. Attach the unit to the mast at a suitable height with the two M6 screws and the mounting clamp.
3. If the local voltage level is other than 230 VAC, make proper reselection with the jumpers at X2 and X3 (under the protective cover).

CAUTION Observe the instructions and warnings in the instruction label inside the unit. Refer to Figure 72 on page 84.

4. With the mains voltage disconnected enter the mains cable through the leftmost cable gland and do the input wiring to the X1 (spring loaded terminals) and Earth (crimp & screw). Tighten the input cable gland.
5. Enter the output power cable(s) through the rightmost cable gland(s). For better protection against RF interference, follow

the grounding instructions in WHP25 User's Guide. Assure that no shield mesh gets on the circuit board.

6. Do the output wiring to the X4 removable screw terminal block (see Figure 72 below). Tighten the output cable gland(s).

7. Carefully reattach the enclosure cover with the four screws.

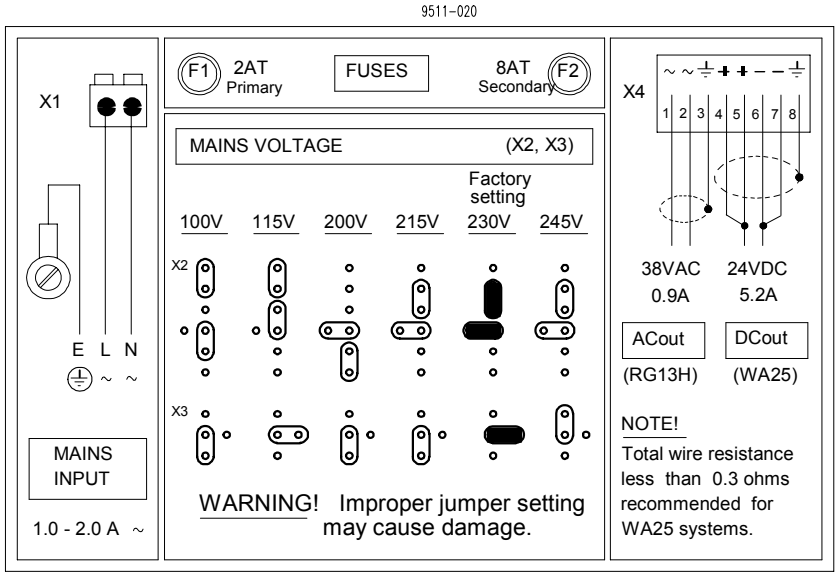


Figure 72 WHP25 Wiring Instructions

WAS425A/WAS425AH

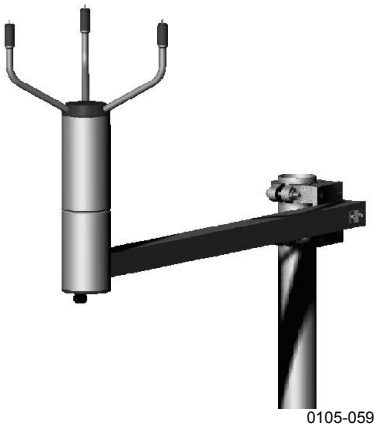


Figure 73 Ultrasonic Wind Sensor with the Sensor Support Arm

The ultrasonic wind sensor comes in a custom shipping container. Carefully remove the sensor from the container. Save the container

and all the packing. You should use this custom container whenever you transport the wind sensor.

WARNING	To protect personnel (and the wind sensor), a lightning rod must be installed with the tip several feet above the wind sensor. The rod must be properly grounded, compliant with all local applicable safety regulations.

CAUTION	Never move the WAS425A Ultrasonic Wind Sensor until it is in its custom shipping container. Otherwise, you will void the warranty.

Mounting

Install the sensor vertically with the arms facing up. The bird spikes discourage birds from either sitting on the sensor arms or building a nest in the cradle of the sensor.

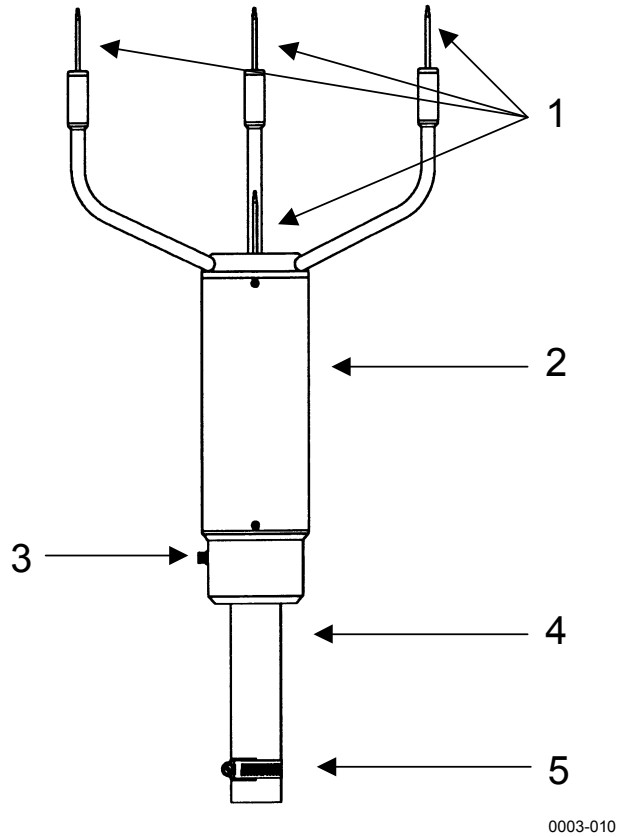


Figure 74 Details of the WAS425A Ultrasonic Wind Sensor

The following numbers refer to Figure 74 on page 85:

1 Bird spikes
2 Sensor body
3 3/16 inch Hex-socket bolt
4 Adapter
5 Clamp

If the bird spikes are not sufficient to keep animals away from the sensor arms, the sensor may also be mounted arms down. This installation method requires the use of a sensor arm WAC425. The sensor arm protects the cable connector from rain.

Below is the mounting procedure for the sensor arm.

1. Remove the hex-socket bolt, if still attached to the sensor body, shown in Figure 74 on page 85 (use a 3/16-inch Allen key).
2. Pull the cable through the horizontal pipe of the sensor arm so that the cable connector remains inside the vertical pipe.
3. Connect the cable to the sensor.
4. Attach the sensor to the vertical pipe of the sensor arm. Insert the hex-socket bolt.
5. Use the clamps to attach the sensor arm to a 60 mm diameter tube.

Wind direction alignment procedure

One transducer arm is permanently marked with "N " for north and a second transducer arm is permanently marked with "S " for south.

NOTE You might find the alignment procedure easier if you mark (e.g., with paint or colored tape) the sensor body to indicate north and south so that you can see it from the ground.

Complete the following steps to aim the wind sensor when using the WAC425 sensor arm for mounting.

1. Use the compass to determine if the horizontal pipe of the sensor arm is properly aligned to north and south. The sensor end should face north.
2. If the alignment is not correct, lower the tower.

3. Loosen the clamps that attach the sensor arm to the mast. Rotate the arm so that the alignment is correct.
4. Raise the tower to the vertical position. Figure 75 below shows the correct alignment.

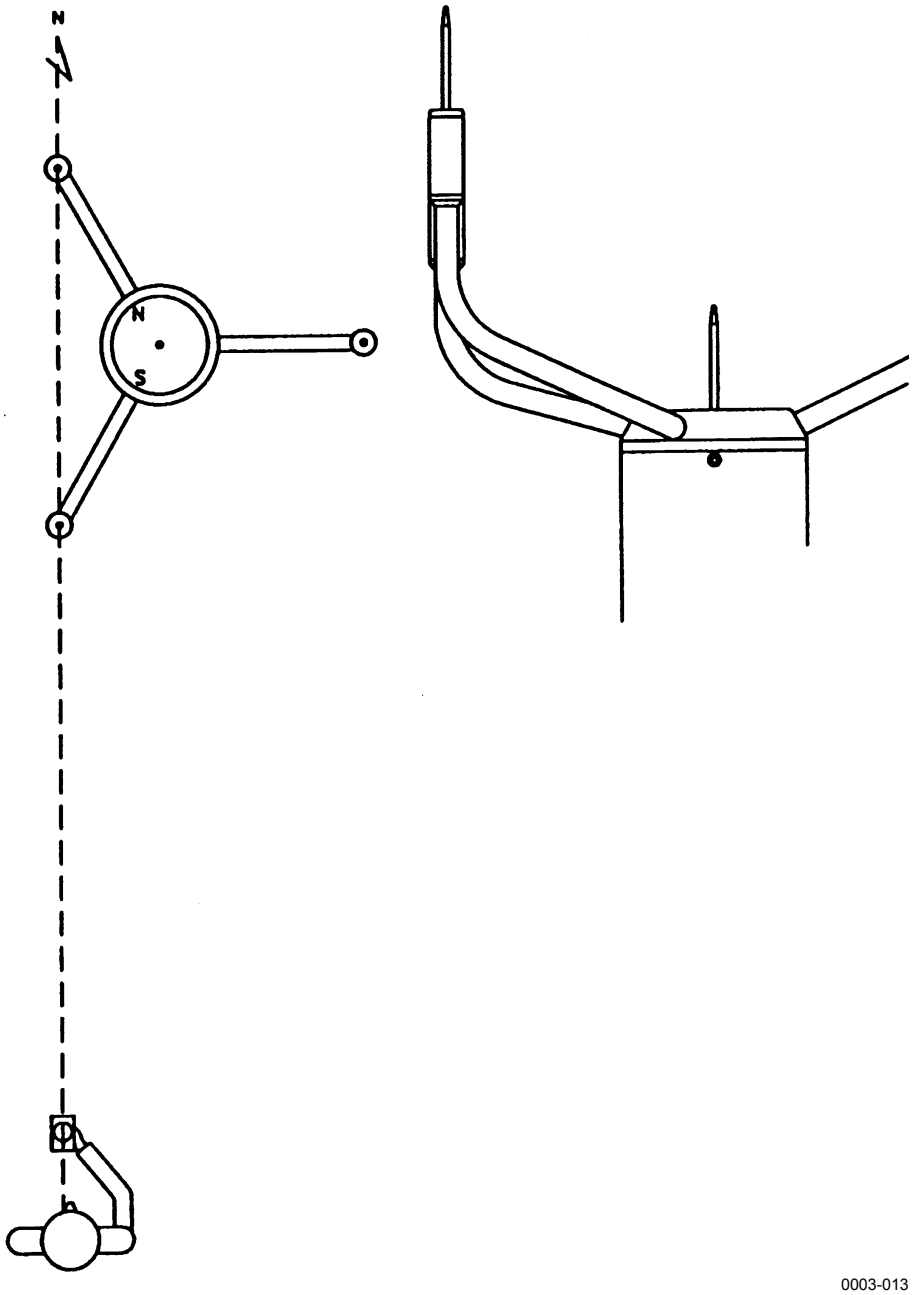


Figure 75 The Correctly Aligned WAS425A Ultrasonic Wind Sensor

Air Temperature and Relative Humidity Sensor

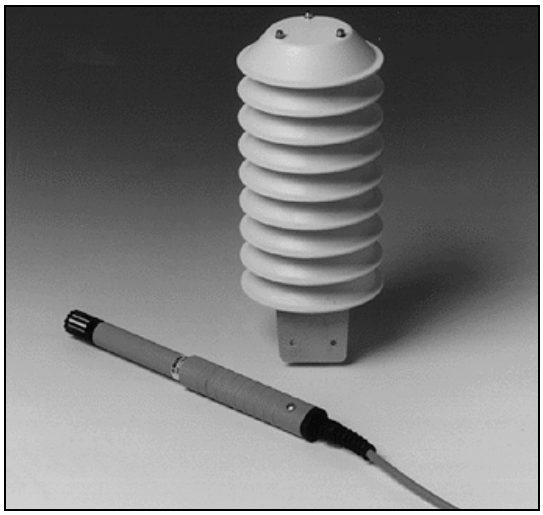


Figure 76 QMH102 Probe and the Radiation Shield

Install the QMH102 Temperature and Relative Humidity Sensor in the following way:

1. Install the radiation shield with the support on the mounting arm using the two screws. See Figure 62 on page 74.
2. Slide the temperature and humidity probe into the shield.
3. Tighten the fastening ring.
4. Guide the sensor cable down along the mast to the enclosure.
5. Connect the signal cable to MAWS (see section Connecting Cables on page 129).

Figure 77 QMH102 Probe and the Shield Installed to the Sensor Arm

Pressure Sensor

The PMT16A Pressure Sensor is located on the CPU board of the QML102 logger (see Figure 78 on page 90) and it is already installed on the logger board. If necessary, it can be accessed by removing the cover of QML102 Logger. The sensor is connected directly into the connector on the board and is fixed on it by one screw.

CAUTION	When handling the sensor, take care not to bent any components on the transducer board.

CAUTION	Beware of electrostatic discharge when touching objects inside the logger housing.

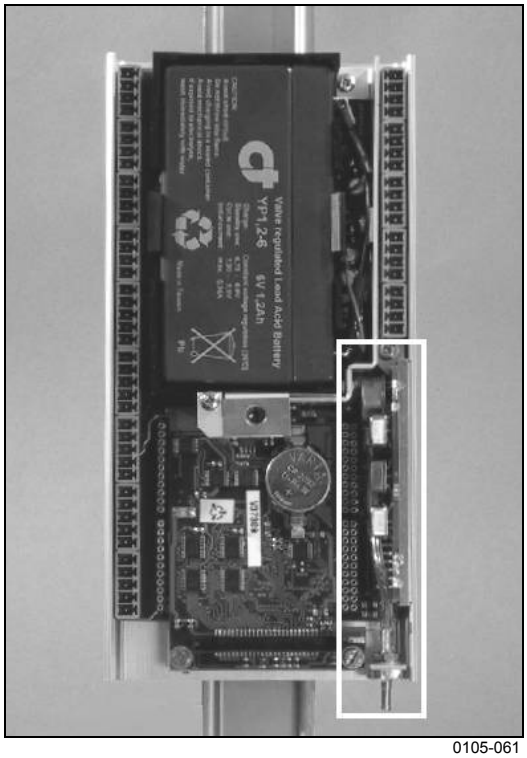


Figure 78 PMT16A on the QML102 CPU Board

CAUTION	Make sure that the vent tube of the pressure sensor is not blocked or bent during transportation.

Precipitation Sensors

QMR102

Due to the low weight of the rain gauge, it must be mounted securely. QMR102 can be installed either using a specific stand RG35003 or on the ground when it is attached to a properly anchored RGB1 base plate with provided studs. As well, the gauge can be mounted via the three holes in the base, for example, to a paving slab. You should use rawl plugs and standard steel studs for this purpose as they provide a means of leveling the rain gauge.

Installing on the Stand RG35003

To install the gauge on the stand, follow the procedure below:

1. Attach the stand (3) to a concrete foundation with the bolts (5). See Figure 79 on page 91.

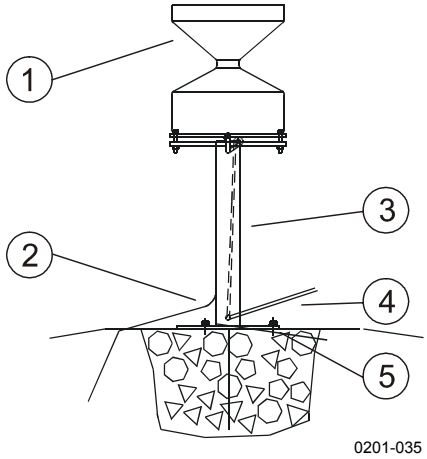


Figure 79 Rain Gauge Installed On a Stand

2. Mount the gauge (1) to the upper plate of the stand using the provided hardware. For an example, see Figure 80 below.

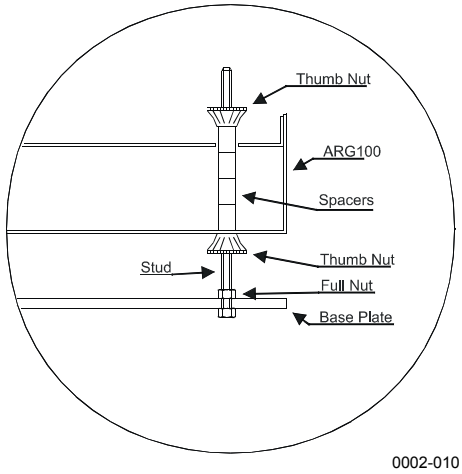


Figure 80 Rain Gauge Attachment

3. Connect the grounding cable (2).
4. Connect the signal cable (4) to MAWS. For the connectors, see section Connecting Cables on page 129.
5. Continue from section Finalizing the Installation below.

Installing on a RGB1 Base Plate

1. Use the RGB1 base plate as instructed in the provided data sheet.
2. Connect the signal cable (4) to MAWS. For the connectors, see section Connecting Cables on page 129.
3. Continue from section Finalizing the Installation below

NOTE	The base plate may be mounted to hard surfaces like concrete by replacing the pegs with screws and rawl plugs. For temporary mounting on hard surfaces use heavy weights on the four corners of the base plate. The height of the weights should be kept as low as possible to cause the minimum interference with the aerodynamics of the rain gauge.

Installing on a Pedestal

1. Drill out three holes in the base to the 6.5 mm in diameter and clean off burr. For details, see Figure 81 below.
2. For the pegs, drill out a hole in the each corner of the pedestal plate. Clean off burr.

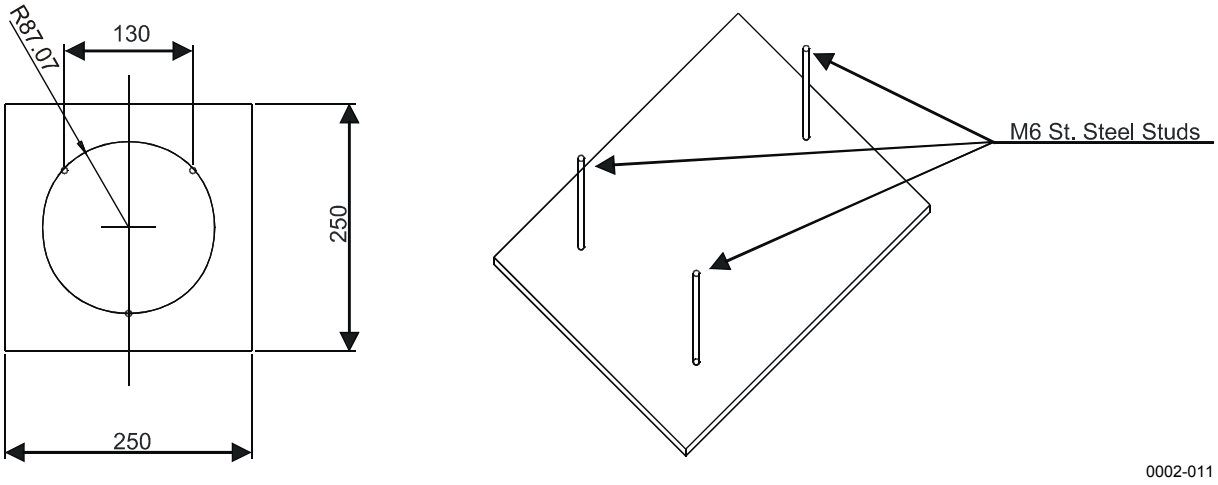


Figure 81 Rain Gauge Pedestal Plate Dimensions

3. Place the pedestal plate with rain gauge assembly on the ground using the pegs supplied. If force is needed, then remove the rain gauge first. See Figure 82 on page 93.

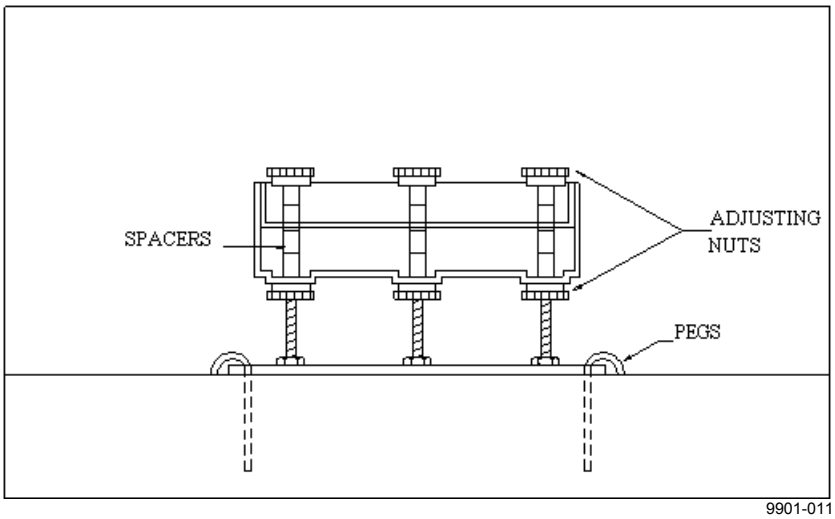


Figure 82 Assembling QMR102 on the Ground with Pedestal Plate

4. Connect the signal cable (4) to MAWS. For the connectors, see section Connecting Cables on page 129.
5. Continue from section Finalizing the Installation below.

Finalizing the Installation

Finalize the installation as described in the following steps:

1. To be able to release the rain gauge's tipping bucket mechanism, and adjust the level, first remove the funnel from its base by unscrewing the three plastic thumbscrews (1). See Figure 83 below.

Figure 83 Funnel Fixing Screw

2. Remove the piece of foam (2) from under the bucket mechanism. This foam may be saved and used whenever the rain gauge is moved. See Figure 84 on page 94.

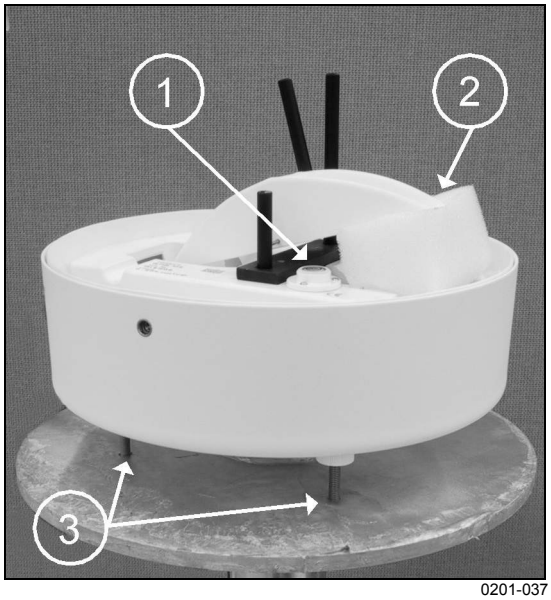


Figure 84 QMR102 Adjustment and the Foam Location

3. It is important to ensure that the rim of the rain gauge is leveled precisely. Failure to do this will result in a systematic error. Use a spirit level (1) and adjust with the fixing screws (3). See Figure 84 above.

4. The cable length can be shortened or lengthened as required. If the cable is lengthened, please ensure a good quality environmental connector, or a heatshrink joint (see Figure 85 below). Extension cables used must be of a similar specification.

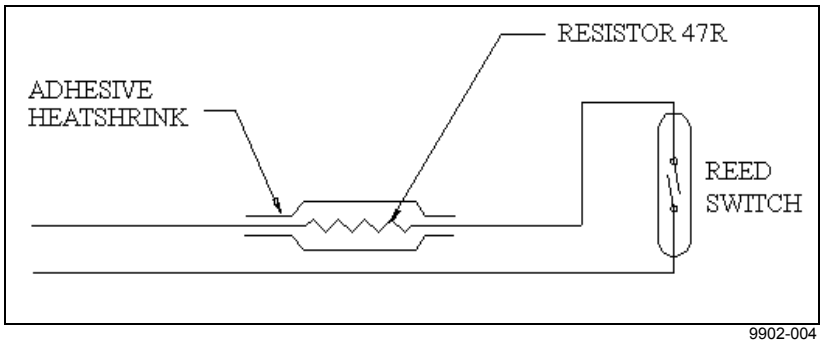


Figure 85 Wiring Diagram of QMR102

NOTE	When using QMR102, the shield must be connected to the ground.

RG13H

1. Loosen the three screws securing the outer tube to the base and lift off the outer tube.
2. Connect the output signal cable through the grommet and into the terminal block provided on the underside of the base. Then seal it using a silicone rubber compound.
3. Place the base onto the site, using a spirit level with the three leveling screws. Secure the locknuts.
4. It is advisable to permanently secure the base using the two holding lugs provided. These accept either 9.5 mm or 3/8" rawlbolts.
5. Carefully remove the restriction to bucket movement, fitted for transit purposes, and check that the bucket does pivot.
6. Replace the outer tube and secure it into position.

DRD11A

1. Install the DRD11A Rain Indication Sensor on DKPSUP (see Figure 86 below).

Figure 86 DRD11A Installed on Support Arm

2. Pull the sensor cable close to the equipment enclosure. Cut the cable to a proper length. Thread the cable through the connector parts in the indicated order 1-2-3-4 (see Figure 87 on page 96).

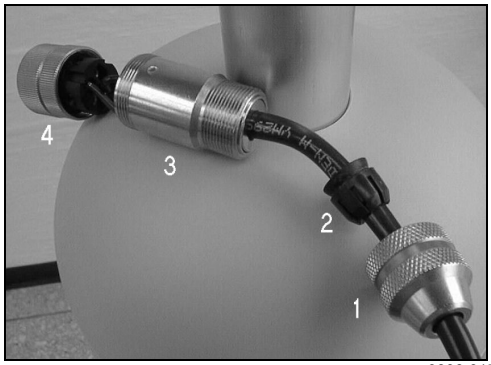


Figure 87 Assembling the Connector

3. Strip the sensor cable wires and connect them to connector terminals according to Table 10 below. Assemble the connector.

Table 10 Cable Pins of DRD11A Rain Indication Sensor

Pin Number	Wire Color	Signal
1	Red	Supply, +
2	Blue	Signal HI
3	Black	Supply, -
4	Yellow	Signal LO
5	Brown	GND

4. Open the enclosure's door and locate the channels on the logger.
5. Remove the connector from the input channel (for example **CH3**, the exact channel depends on your configuration). Insert adapter QLA002 to the channel and place the connector on top of it as shown in Figure 88 below.

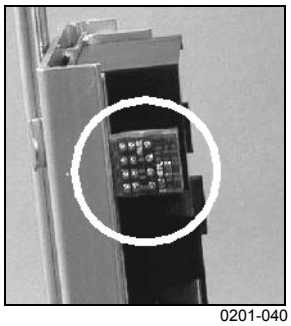


Figure 88 Adapter Installed to Connector

6. Connect the signal cable to an available receptacle (for example **CH3**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).
7. Heating power for the DRD11A must be taken from a separate 12 V supply, which is located inside the equipment enclosure.

First, remove the wire from pin E of the input channel connector and connect it to +12 V connector of the QBR101 battery regulator. Connect the brown wire of DRD11A to the GND connector of QBR101.

DCU7210

The DCU7210 snow level sensor is installed on the sensor arm as shown in Figure 89 below.

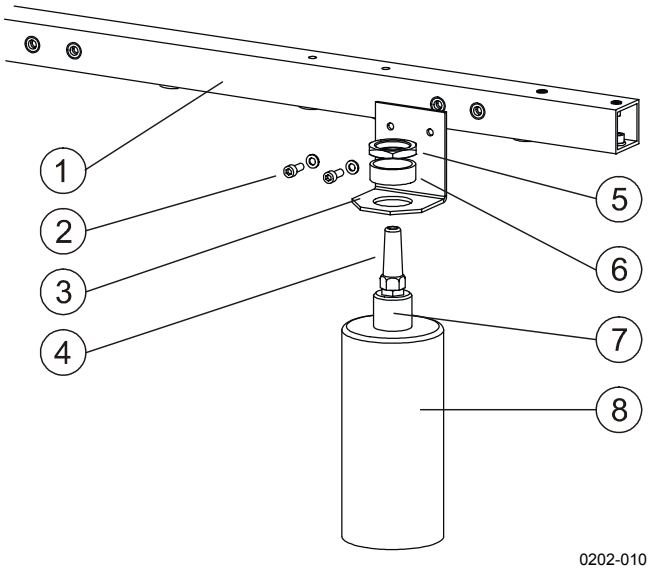


Figure 89 Installing DCU7210 Snow Level Sensor

1. Attach the plate (3) to the sensor arm (1) with the provided spacers and bolts (2). Install the sensor (8) through the auger in the plate (3) and insert the spacer (6). Tighten the hex nut (5) to the 1-inch NPT nipple (7) on the back of the sensor (8).
2. Pull the sensor cable through the plate (3) and lead it inside the sensor arm (1). Cut the cable to a proper length. Thread the cable through the connector parts in the indicated order 1-2-3-4 (see Figure 87 on page 96).
3. Strip the sensor cable wires and connect them to connector terminals according to Table 11 below. Assemble the connector.

Table 11 Cable Pins of DCU7210

Pin Number	Wire Color	Signal
1	Orange	Supply, +
2	White	Signal HI
4	Green	Signal LO

4. Open the enclosure's door and locate the logger.

5. Remove the connector from the input channel (for example **CH3**, exact channel depends on your configuration) on the logger. Insert adapter QLA004 to the channel and place the connector on top of it (see Figure 90 below).

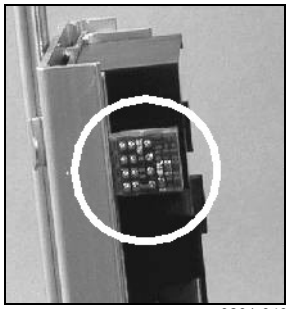


Figure 90 Adapter Installed to Connector

6. Connect the signal cable to the previously modified receptacle (for example **CH3**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

Solar Radiation Sensors

QMS101/QMS102

The pyranometers (QMS101 or QMS102) can be installed on a sensor arm as follows:

1. Attach the pyranometer (6) to its mounting plate (2) using the fixing accessories (5, 8, and 9) provided. For the numbers, see Figure 91 on page 99.
2. Lead the cable (7) through the sensor arm (1).
3. Use the bolts (4) and the spacers (3) to attach the mounting plate (2) to the sensor arm (1).
4. After you have installed the sensor, connect the signal cable to the **Sol. Rad.** connector at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

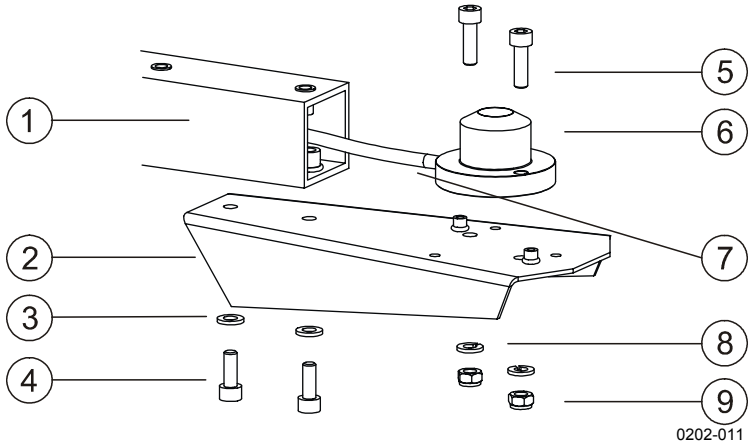


Figure 91 Installing QMS101 or QMS102 Pyranometer

CM6B

The pyranometer can be installed as follows:

1. Install the sensor (see Figure 92 below).

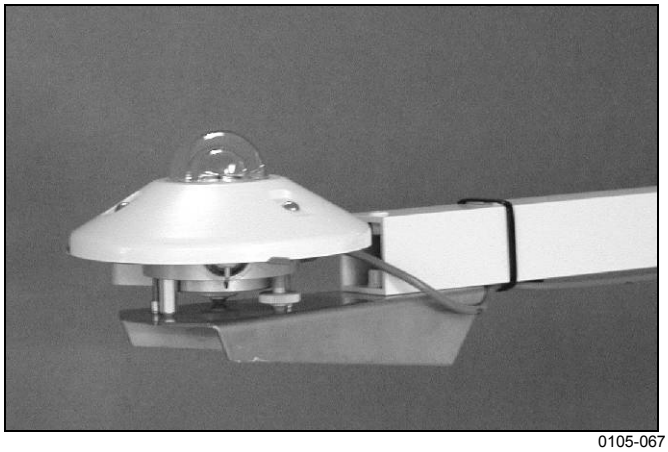


Figure 92 CM6B Installed on Support Arm

2. Pull the sensor cable close to the equipment enclosure. Cut the cable to a proper length. Thread the cable through the connector parts in the indicated order 1-2-3-4 (see Figure 87 on page 96).
3. Strip the sensor cable wires and connect them to connector terminals according to Table 12 below. Assemble the connector.

Table 12 Cable Pins of CM6B Solar Radiation Sensor

Pin Number	Wire Color	Signal
2	Red	Signal HI
4	Blue	Signal LO

4. Connect the signal cable to the connector **Sol. Rad.** at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

CM11

See installation of CM6B on page 99.

QMN101

It is recommended to install the sensor at least 1.5 meters above the surface in order to avoid shading effects and to promote spatial averaging. Install the sensor as follows:

1. Attach the radiometer (6) to the extension arm (5). For the numbers, see Figure 93 below.
2. Attach the sensor's extension arm (5) with the adapter (3).
3. Lead the cable (2) through the sensor arm (1).
4. Use the bolts (4) to attach the mounting piece (3) to the sensor arm (1).
5. After you have installed the sensor, connect the signal cable to **NET Rad.** connector at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

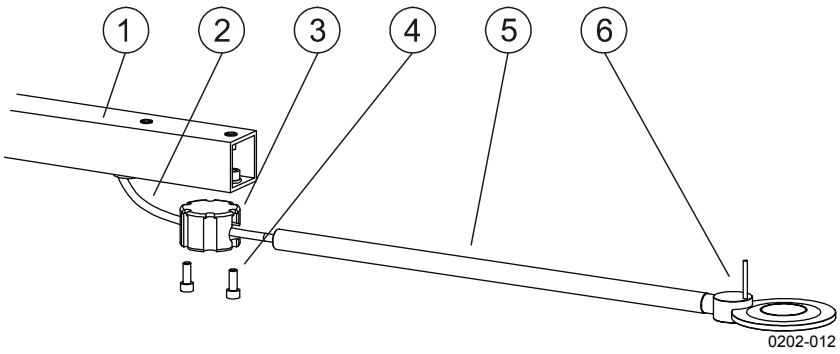
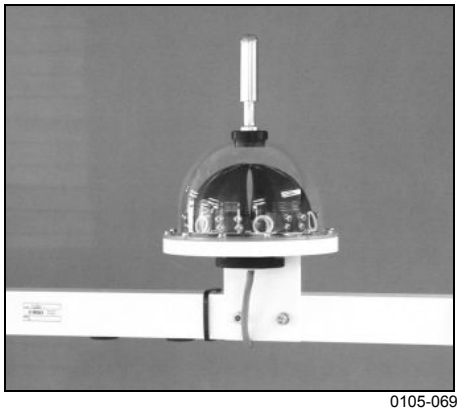


Figure 93 Installing QMN101 Net Radiometer

DSU12

1. Install the sunshine duration sensor (see Figure 94 on page 101).
2. Pull the sensor cable close to the equipment enclosure. Cut the cable to a proper length. Thread the cable through the connector parts in the indicated order 1-2-3-4 (see Figure 87 on page 96).



0105-069

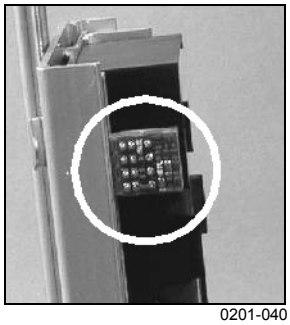
Figure 94 DSU12 Installed on Support Arm

3. Strip the sensor cable wires and connect them to connector terminals according to Table 13 below. Assemble the connector.

Table 13 Cable Pins of DSU12 Sunshine Duration Sensor

Pin Number	Wire Color	Signal
2	Red	Signal HI
3	Blue	Supply, -

4. Open the enclosure's door and locate the logger.
5. Remove connector from the input channel (for example **CH3**, exact channel depends on your configuration). Insert adapter QLA003 to the channel and place the connector on top of it (see Figure 95 below).



0201-040

Figure 95 Adapter Installed to Connector

6. Connect the signal cable to an available receptacle (for example **CH3**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

Soil Temperature Sensors

QMT103

The QMT103 soil/water temperature sensor has a ready-made cable and a connector. Connect the signal cable to an available receptacle (for example **Soil T1**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

Figure 96 QMT103 Soil/Water Temperature Sensor

QMT107

During a typical installation, QMT107 probe is pressed into pre-formed holes, but they can also be placed into excavated holes that are then filled. On hard or rocky ground, a pilot hole is pre-formed with an auger rod. Drill a hole according to the following procedure:

1. Choose a desired location for the probe. Assure that probe holes are located within cable length of the logging unit.
2. Drill a hole into the ground with the auger held as straight as possible. After you have drilled about 20 cm, extract the auger from the hole.

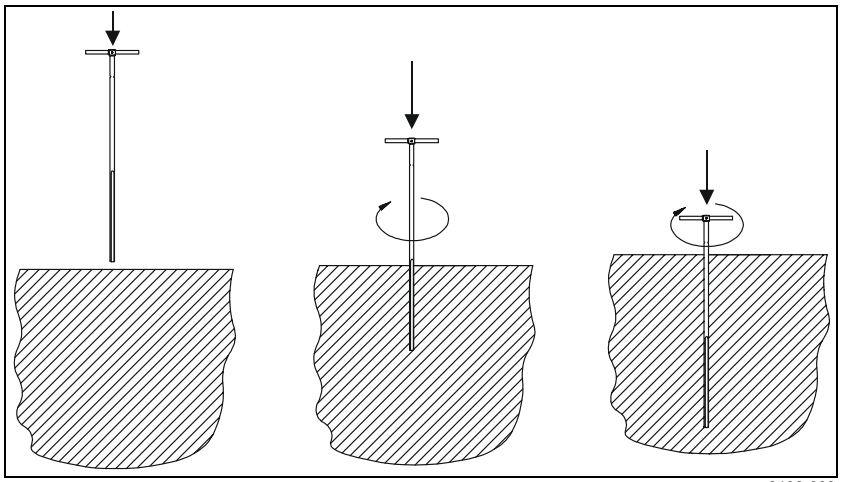


Figure 97 Drilling Procedure

CAUTION	Do not use a hammer to pound the auger into ground.

3. Remove soil from the auger, for example with a screwdriver. Refer to Figure 98 below.

WARNING	Do not use fingers to clean the auger. The edges are sharp.

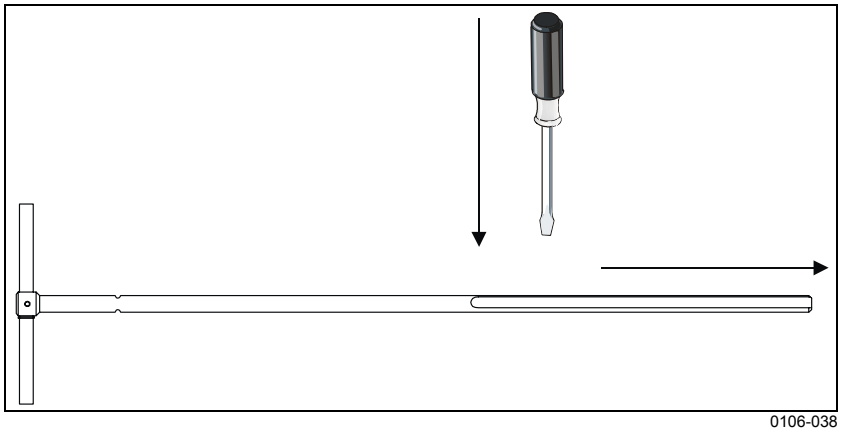


Figure 98 Cleaning the Auger with a Screwdriver

4. Repeat steps 2 and 3 until you have reached the desired depth. The maximum drilling depth is approximately 115 cm.

Insert the probe into the hole according to the following procedure:

1. Remove the auger from the hole.

2. Insert the probe into the hole and press it down as deep as possible by hand. Insert the probe deep enough into the soil so that the soil/air boundary is at the ground level line. The ground level line is marked on the sensor (see Figure 99 below).

CAUTION	Never use a hammer or other instrument directly on the head of a probe. If too much force is applied to the probe, damage to the electronics inside may result.

NOTE	Any delay in inserting the probe into the drilled hole may allow moisture to swell the hole sides, or fill the hole with water.

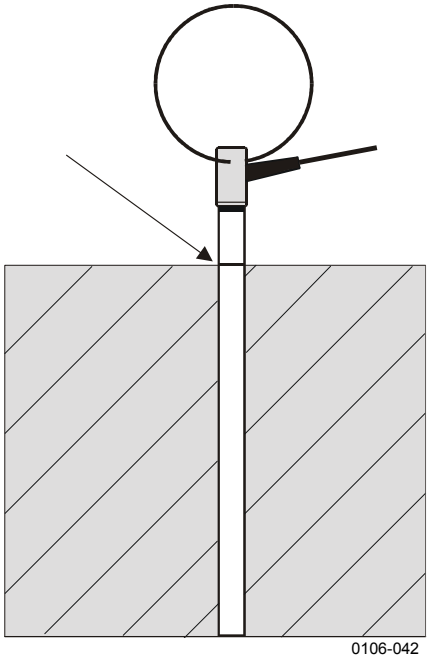


Figure 99 Soil Temperature Probe Inserted Correctly, Arrow Pointing to Ground Level Line

CAUTION	DO NOT drive or press probes directly into soil of unknown composition. DO NOT bend or flex probes during insertion or extraction. DO NOT attach unapproved electrical devices or test equipment to the probe. DO make a pilot hole prior to each probe insertion, unless the soil consists of homogenous, loose sand. DO inspect and clean the probe connector prior to each use. Note that probe warranty is void if a hammer or unapproved tool is used to drive the probe into the soil.

3. Connect the signal cable to an available receptacle (for example **Soil T1**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

Soil Moisture Sensor

1. Install the ML2x sensor. The sensor can either be inserted or buried into the soil as shown in Figure 100 below and Figure 101 on page 106.

Figure 100 ML2x Soil Moisture Sensor

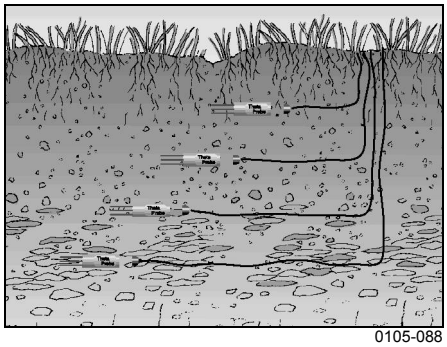


Figure 101 Buried ML2x Sensors

2. Pull the sensor cable close to the equipment enclosure. Cut the cable to a proper length. Thread the cable through the connector parts in the indicated order 1-2-3-4 (see Figure 87 on page 96).
3. Strip the sensor cable wires and connect them to connector terminals according to Table 14 below. Make sure that the spring of lead-in connector is in good contact with the shield. Assemble the connector.

Table 14 Cable Pins of ML2x Soil Moisture Sensor

Pin Number	Wire Color	Signal
1	Red	Supply, +
2	Yellow	Signal HI
3	Blue	Supply, -
4	Green	Signal LO

4. Connect the signal cable to an available receptacle (for example **Soil T2**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

Water Level Sensors

QMV101/QMV102

For the location of the QMV101 and QMV102 water level sensors, see section Water Level on page 67. QMV sensors have a ready-made cable and a connector. Connect the signal cable to an available receptacle (for example **CH4**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

QSE101

A common application for the QSE101 shaft encoder is measuring stream, lake, or tank level by using a float and pulley arrangement. Use a threaded-shaft encoder with a supplied pulley. Figure 102 below sketches an installation of the components with a stilling well.

1. Attach the pulley to the shaft.
2. Attach the incremental shaft encoder to a flat surface using bolts or screws through the four holes in the two mounting flanges of the housing. You can install the sensor in any orientation.
3. Then run a tape over the pulley that has a float attached to one end and a counterweight on the other. Weights or other mechanical loads at right angles to the shaft center line should not exceed 4.5 kg. Larger loads increase the starting torque and distort the bearings, decreasing the bearing life.
4. Protect the float from waves and currents by using a stilling well.
5. Enclose everything in a gauge house.

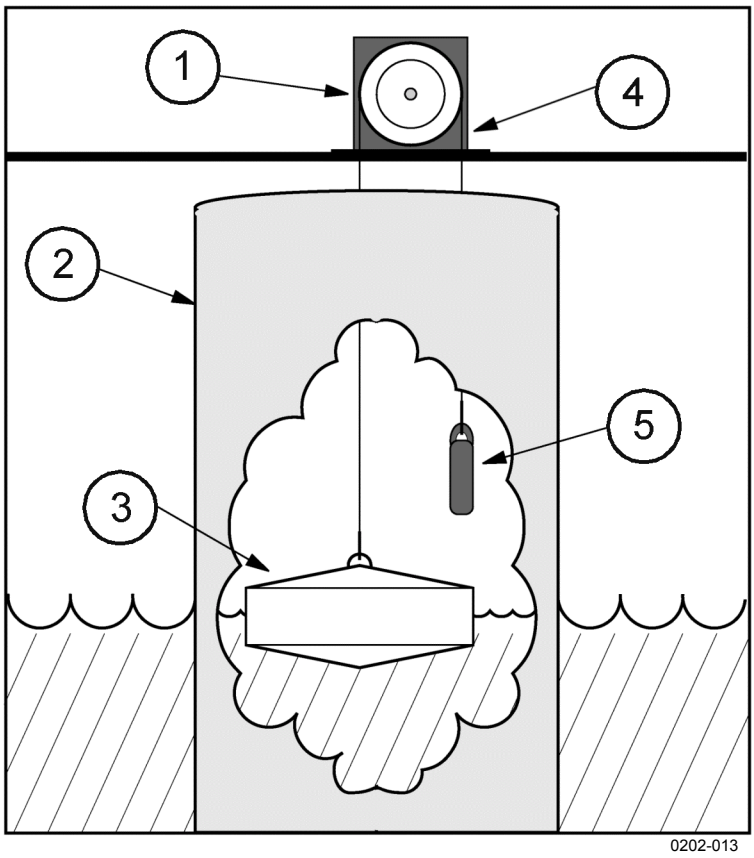


Figure 102 QSE101 Installation in a Stilling Well

The following numbers refer to Figure 102 on page 107:

1 = QSE101 Shaft Encoder
2 = Stilling well
3 = Float
4 = Float tape
5 = Counter-weight

6. The QSE101 with SDI-12 output connects to a serial data communication line configured according to the SDI-12 standard. The SDI-12 line uses one wire for data and is limited to a maximum length of 60 meters. In MAWS the SDI-12 line is connected through the DSI486 module. Install the DSI486 module inside the logger's cover on the MOD2 connector block. Factory settings of DSI486's jumpers (X3:1-2, X3:3-4, X4:1-2 and X6:1-2) are suitable for this communication mode. For installation instructions, see section DSI486 on page 118.
7. Modify the wiring at the logger according to the Table 18 on page 114.

Table 15 Modified Wiring with QSE101

Wire Color	Standard Connection Pin at the Logger (COM2)	Modified Connection Pin at the Logger
Red	B1	Move the wire from COM terminal to the 0 V terminal.
Brown	B2	Move the wire from COM terminal to the +12 V terminal.
White	B3	Leave as is. This wire is not in active use.
Black	B4	Leave as is. This wire is not in active use.
Blue	B5	Leave as is. This wire is used for the SDI-12 data transfer.

8. Connect the signal cable to a receptacle that has the DSI486 communication module connected, normally **COM2**, at the bottom of the equipment enclosure (see section Connecting Cables on page 129).
9. Configure the sensor with MAWS Lizard. For more information, refer to the separate Technical Reference.

DCU7110

For the location of the DCU7110 water level sensor, see section Water Level on page 67. The sensor is installed on the sensor arm as shown in Figure 89 on page 97.

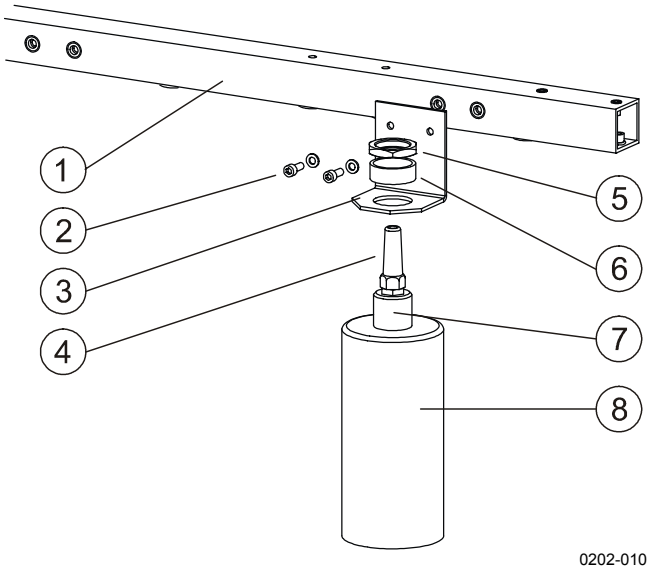


Figure 103 Installing DCU7110 Water Level Sensor

1. Attach the plate (3) to the sensor arm (1) with the provided spacers and bolts (2). Install the sensor (8) through the auger in the plate (3) and insert the spacer (6). Tighten the hex nut (5) to the 1-inch NPT nipple (7) on the back of the sensor (8).
2. Pull the sensor cable through the plate (3) and lead it inside the sensor arm (1). Cut the cable to a proper length. Thread the cable through the connector parts in the indicated order 1-2-3-4 (see Figure 87 on page 96).
3. Strip the sensor cable wires and connect them to connector terminals according to Table 16 below. Assemble the connector.

Table 16 Cable Pins of DCU7110

Pin Number	Wire Color	Signal
1	Orange	Supply, +
2	White	Signal HI
4	Green	Signal LO

4. Connect the signal cable to an available receptacle (for example **CH4**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).
5. Open the enclosure's door and locate the logger.
6. Remove the connector from the input channel at the logger, for example, **CH4.** The exact channel depends on your configuration. Insert adapter QLA004 to the channel and place the connector on top of it (see Figure 104 on page 110).

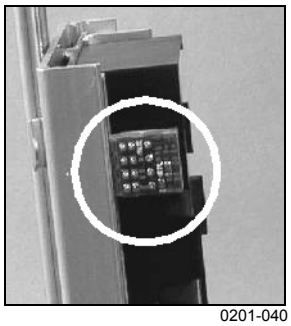


Figure 104 Adapter Installed to Connector

Leaf Wetness Sensor

You should have the following components when installing QLW101 Leaf Wetness Sensor to DKP12SUP1/2 (included in DKP12SUP delivery):

- Hexagon bolts
- Lock washers
- 6 mm Allen wrench

You may need medium Phillips screwdriver and an adjustable wrench (to tighten hex nuts if installing on a pipe) in order to complete the installation.

You may test the sensor before you install it. The instructions below provide a quick description of the suggested test procedure.

1. Attach the sensor cable to an available receptacle (for example **CH3**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).
2. Configure the sensor. See the MAWS Lizard User's Guide for instructions.
3. Drop or spray water onto the sensor and make sure the reading changes.

To mount the sensor against a wooden surface, secure the sensor to the surface using wood screws (see Figure 105 on page 111).

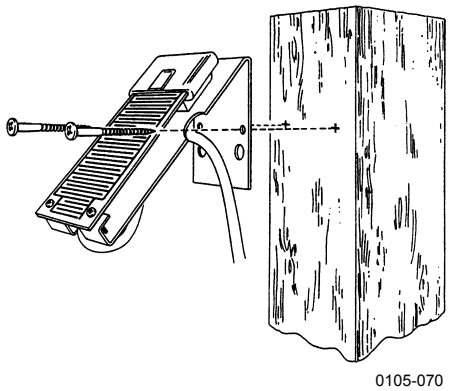


Figure 105 Mounting QLW101 to a Wooden Surface

To mount the sensor to a mast with an outside diameter between 25 and 31 mm , secure the sensor to the pipe using the U-bolts, flat washers, and hex nuts as shown in Figure 106 below. Use a wrench or adjustable wrench to tighten the hex nuts.

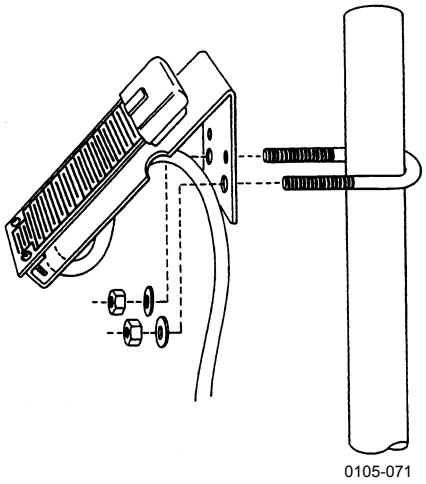


Figure 106 Mounting QLW101 to a Pole

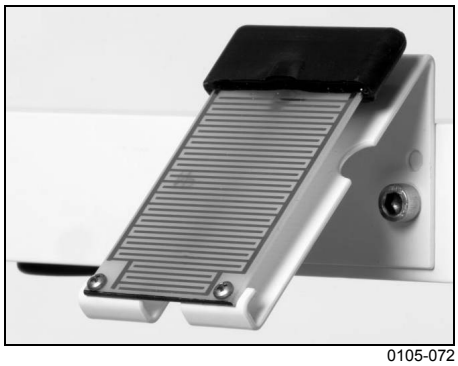


Figure 107 QLW101 Installed on Support Arm

1. Install the sensor as explained in Figure 105 on page 111, Figure 106 on page 111, and Figure 107 on page 111.
2. Pull the sensor cable close to the equipment enclosure. Cut the cable to a proper length. Thread the cable through the connector parts in the indicated order 1-2-3-4 (see Figure 87 on page 96).
3. Strip the sensor cable wires and connect them to connector terminals according to Table 17 below. Assemble the connector.

Table 17 Cable Pins of QLW101 Leaf Wetness Sensor

Pin Number	Wire Color	Signal
1	Red	Supply, +
2	White	Signal HI
3	Black (two wires)	Supply, -

4. Connect the signal cable to an available receptacle (for example **CH3**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).
5. Open the enclosure's door and locate the logger.
6. Remove the connector from the input channel at the logger, for example, **CH3.** The exact channel depends on your configuration. Insert adapter QLA001 to the channel and place the connector on top of it (see Figure 108 below).

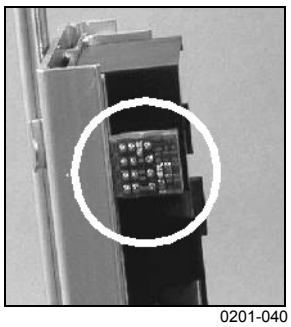

0201-040

Figure 108 Adapter Installed to Connector

Fuel Moisture Sensor

CAUTION It is important to keep the wooden dowel part of the sensor clean. Avoid touching the dowel with bare hands. Any contact with grease or oil will prevent the sensor from exchanging moisture and will make the calibration invalid.

QFM101 Fuel Moisture Sensor uses two analog channels of the logger: one for the temperature measurement and another for the moisture measurement. Moisture is measured via one of the channels CH1 to CH3. You should connect the sensor cable to the appropriate channel. Temperature is measured with one of the channels CH4 to CH7 and therefore you should modify the wiring as instructed below.

You should install the QFM101 sensor 30 cm above the forest floor and orient the sensor parallel to the ground. The mounting bracket (1 in Figure 109 below) is not included in the sensor delivery. A rubber-lined ring clamp (3) and the screw (4) are included with the sensor in the package. To install the sensor, follow the procedure below:

1. Slide the ring clamp (3) onto the sensor body (2) and connect the cable to the sensor.
2. Turn the sensor so that the two wire loops imbedded in the wooden dowel will be horizontal. That is, the wires must be on the sides of the sensor, not the top and bottom. Tighten the clamp with the screw (4).

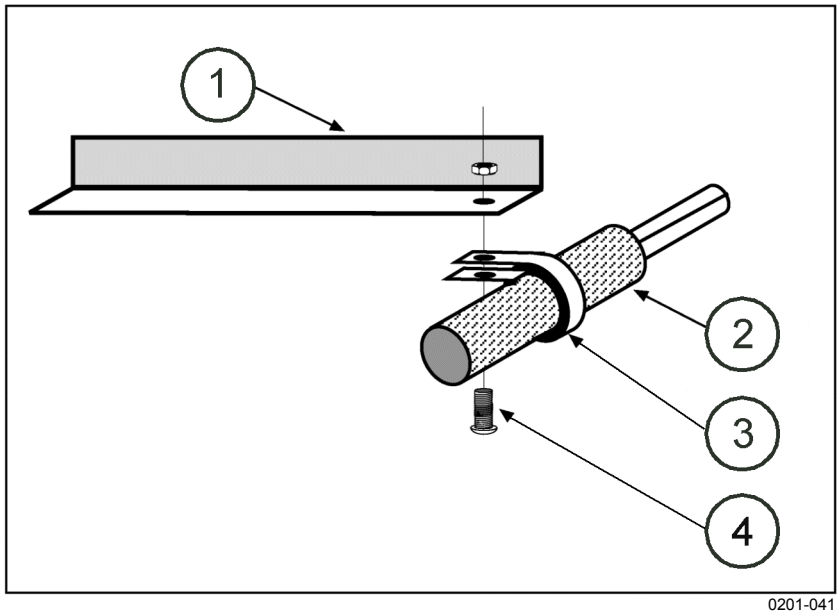


Figure 109 Installing the Sensor with the Clamp

3. Secure the slack in the cable to the tower leg or the sensor bracket with a cable tie.
4. Open the enclosure's door and locate the logger.
5. Select one of the analog channels, CH1 ... CH3, and place the connector to the selected input channel at the logger. The exact channel depends on your configuration.
6. Remove the connector from the selected temperature measurement channel, that is, one of the channels CH4 ... CH7. The removed cables and their connector are not needed. Insert adapter QLA005 to the channel and place the connector on top of it. See Figure 110 below.

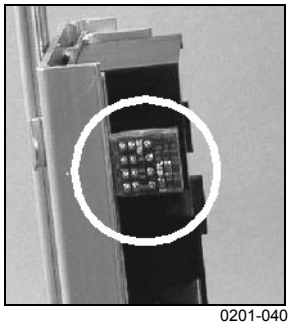


Figure 110 Adapter Installed to Connector

7. Modify the wiring according to the Table 18 below.

Table 18 Modified Wiring with QFM101

Wire Color	Standard Connection Pin at the Logger	Modified Connection Pin at the Logger
Red	Not connected.	**Connect the wire to the terminal C of the selected temperature measurement channel (CH4 ... CH7).**
Brown	E	Leave as is. This wire is used for the moisture measurement.
White	H	Leave as is. This wire is used for the moisture measurement.
Black	L	**Move the wire to the terminal E of the selected temperature channel (CH4 ... CH7).**
Blue	C	Leave as is. This wire is used for the moisture measurement.

8. Connect the signal cable to the selected receptacle (for example **CH3**) at the bottom of the equipment enclosure (see section Connecting Cables on page 129).

Smart Sensors

CT25K

See installation instructions on the CT25K User's Guide.

PWD11/PWD21

See installation instructions on the PWD11/PWD21 User's Guide.

FD12

See FD12 User's Guide.

FD12P

See FD12P User's Guide.

Installing Communication Devices

Communication Modules

Modules can be attached on the circuit board to provide communication channels for MAWS. For the placement of the modules, see Figure 111 on page 116. The modules can simply be pushed on the connector blocks MOD1 and/or MOD2. Module options include DSU232, DSI485A, DSI486, and DMX501. By default, the modules are installed as described in Table 19 below.

Table 19 Default Configuration for Communication Modules

Module	Connector Block	Port
DSU232	MOD1	COM1
DSI485A / DSI486	MOD2	COM2
DMX501	MOD2	COM2

CAUTION When inserting, be careful not to bend the connector pins.

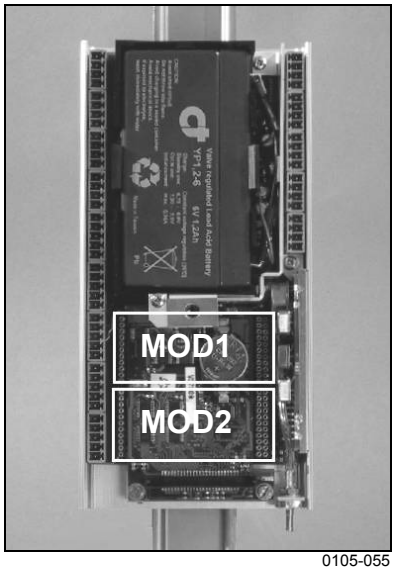


Figure 111 Module Placement

DSU232

The DSU232 is an unisolated RS-232 module that will provide either a double serial channel without handshaking or a single RS-232 with handshaking. It can also feed 12 V (45 mA) for a serial sensor, when used in sensor mode.

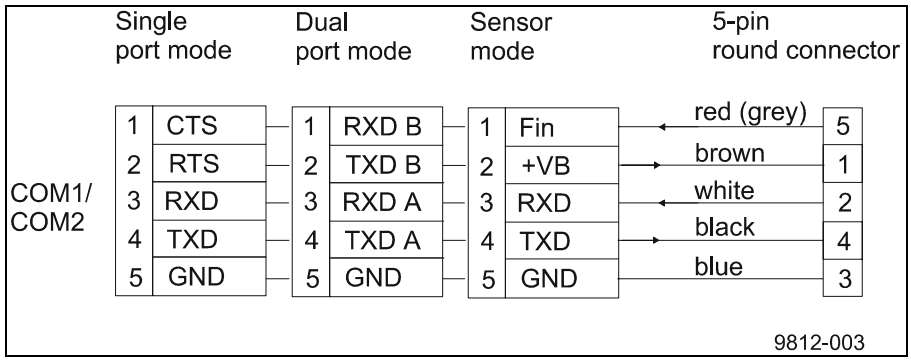


Figure 112 DSU232 Wiring Diagram

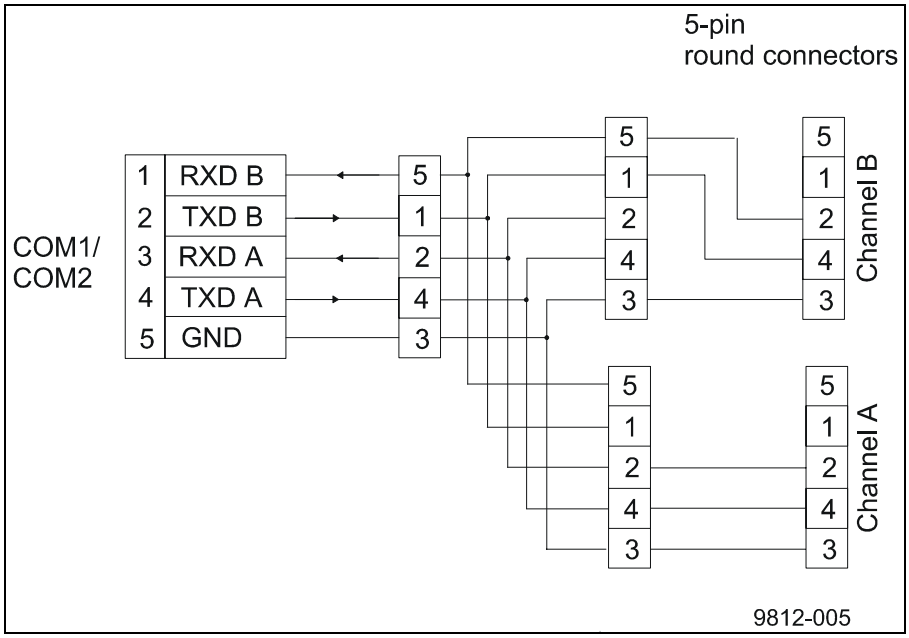


Figure 113 Suggested T-connection in Dual Port Mode

DSI485A

The DSI485A communication module can be configured for either 2-wire line or for 4-wire line when receive and transmit lines are separated. If the module is configured for a 2-wire line, the transmitter is enabled only during the transmission. Normally, the 2-wire connection is used to connect several devices to the same communication line. The 4-wire mode is a default mode.

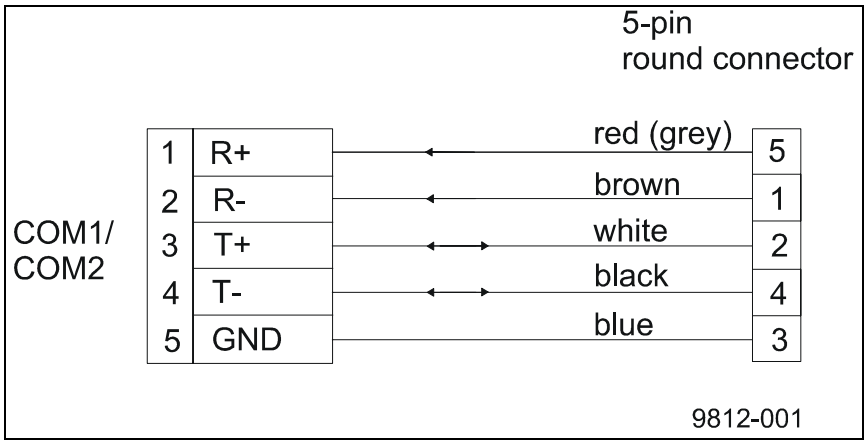


Figure 114 DSI485A Wiring Diagram

NOTE	In 2-wire mode, only T+ and T- pins are used.

DSI486

Channel A is always used in RS-485 -mode. In 2-wire RS-485, both transmitted and received data is sent via this channel. In 4-wire RS-485 this channel can either transmit or receive depending on the configuration. Jumper X4 defines the line terminating resistor for the data channel A. Remove the jumper X4, if you do not need the terminating resistor of DSI486. Figure 115 below provides a schematic wiring diagram for dual RS-485.

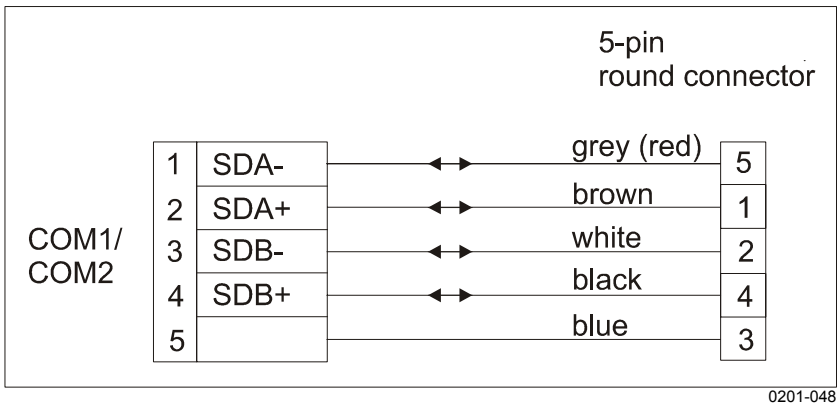


Figure 115 DSI486 Wiring Diagram for Dual RS-485

Channel B can be used either in the RS-485 mode or in the RS-232 mode. In 2-wire RS-485, both transmitted and received data is sent via this channel. In 4-wire RS-485, this channel can either transmit or receive depending on the configuration.

Figure 115 above provides a schematic wiring diagram for the dual RS-485 connection, the dual 2-wire connection utilizing both channels. The correct jumper settings for the channel B are listed in Table 20 below. The jumpers are located on the module as illustrated in Figure 116 on page 119.

Table 20 The Jumper Settings for Channel B in the RS-485 Mode

Jumper	Connected Pins	Function
X3	1-2	Sets the RS-485 mode active for the channel B.
	3-4	
X6	1-2	
X5	1-2	The line terminating resistor is in use with RS-485.

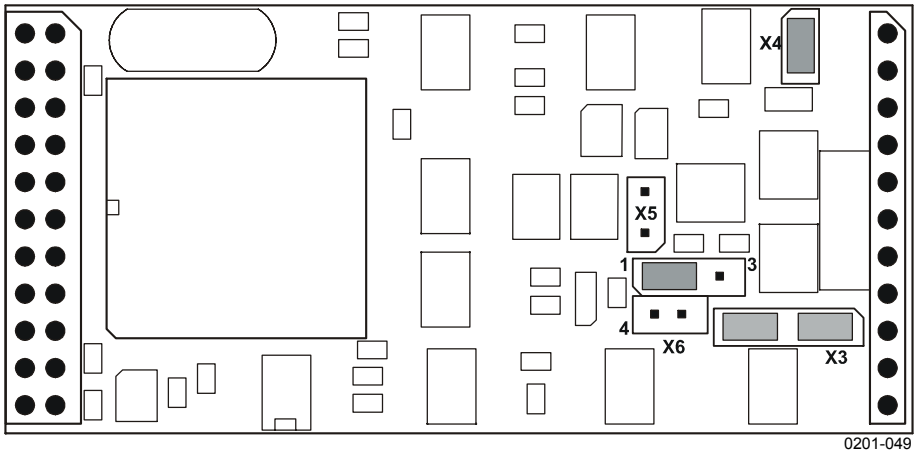


Figure 116 DSI486 Default Jumper Locations

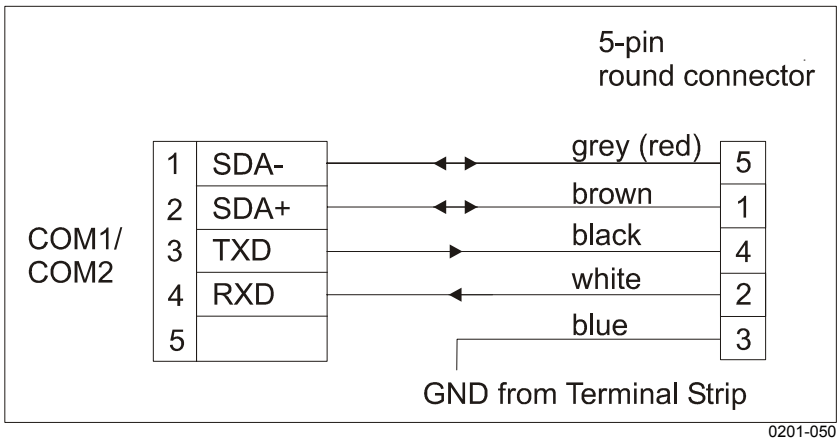


Figure 117 DSI486 Wiring Diagram for RS-485 and RS-232

Figure 117 above provides a schematic wiring diagram for the combination of the RS-485 and RS-232 connection. The correct jumper settings for the channel B are listed in Table 21 below.

Table 21 The Jumper Settings for Channel B in the RS-232 Mode

Jumper	Connected Pins	Function
X3	2-3	Sets the RS-232 mode active for the channel B.
X6	1-4	
	2-5	
X5	None	The line terminating resistor is not in use at all.

The DSI486 module provides also SDI-12 connection. The SDI-12 line uses one wire for data and is limited to a maximum length of 60 meters. Figure 118 on page 120 provides a schematic wiring diagram

for the SDI-12 connection and the 12 VDC power supply for a sensor. The jumper settings should be as shown in Figure 116 on page 119.

Simultaneously with the SDI-12, you can connect channels A and B in 2-wire RS-485 mode. If you take all three channels in use, you either need three free connectors in the flange or an optional junction box.

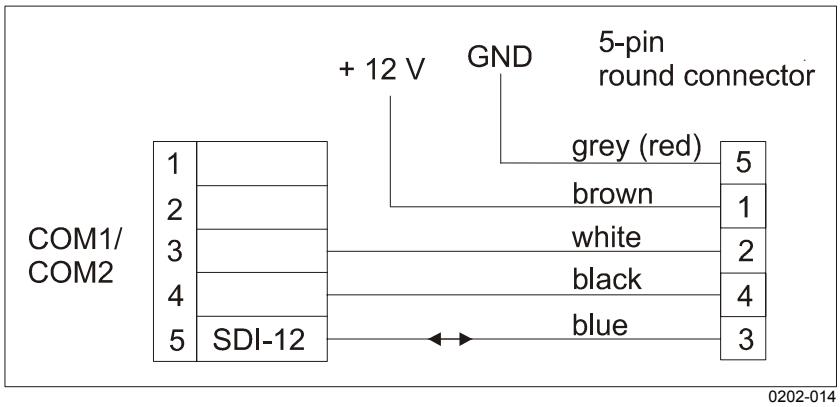


Figure 118 DSI486 Wiring Diagram for SDI-12 and 12 VDC Power Supply

DMX501

The DMX501 modem module can be configured for point-to-point line or for a multidrop modem network. If a modem is configured for multidrop use, the outgoing carrier is valid only during transmission. If MAWS is the master in the multidrop network, DMX501 can be normally configured for point-to-point use.

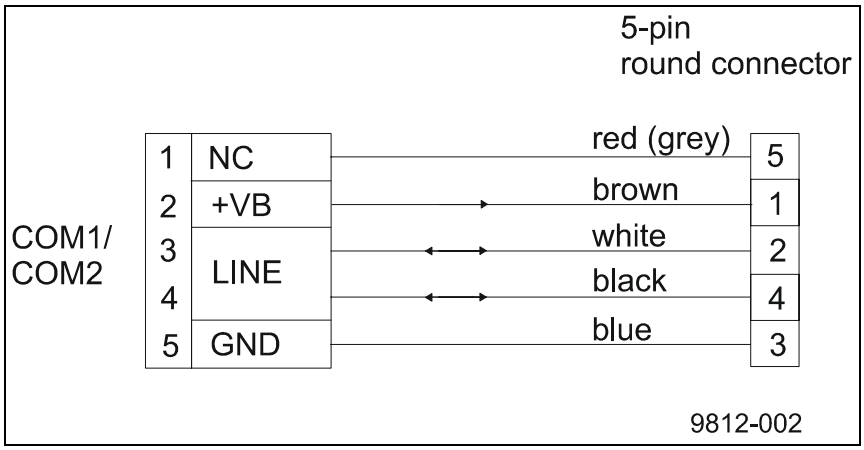


Figure 119 DMX501 Wiring Diagram

GSM Data Modem

Install the GSMM20T GSM Data Modem on the door plate of the enclosure with two self-tapping screws, see Figure 120 below. Connect the wires according to Figure 121 on page 122.

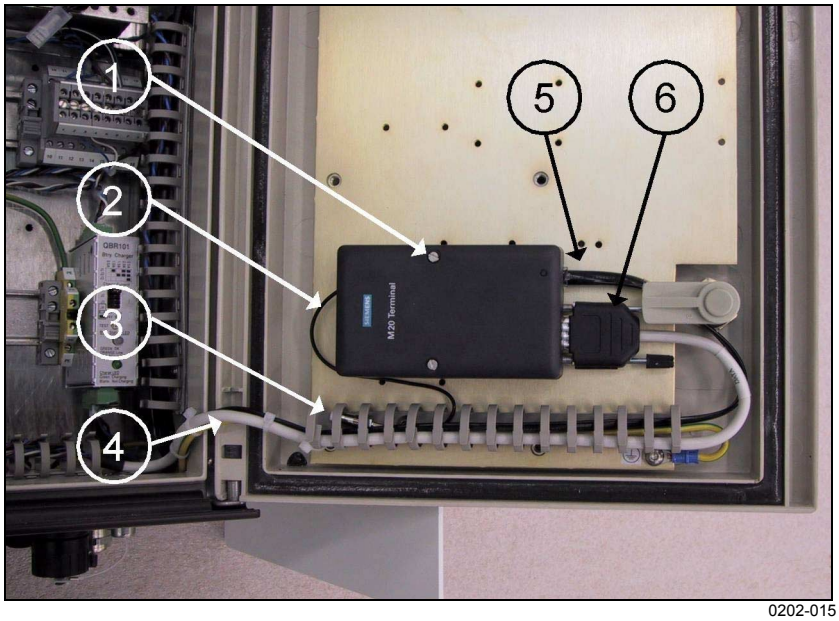


Figure 120 Standard Installation of GSM Modem

The following numbers refer to Figure 120 above.

1 = Self-tapping screw B3.9 × 9.5, 2 pieces
2 = Antenna cable
3 = Antenna connector
4 = Cables tied together with cable ties
5 = Power connector
6 = Signal cable connector

After connecting the cables, configure the modem with the Lizard Setup software. For more information, refer to the separate Technical Reference.

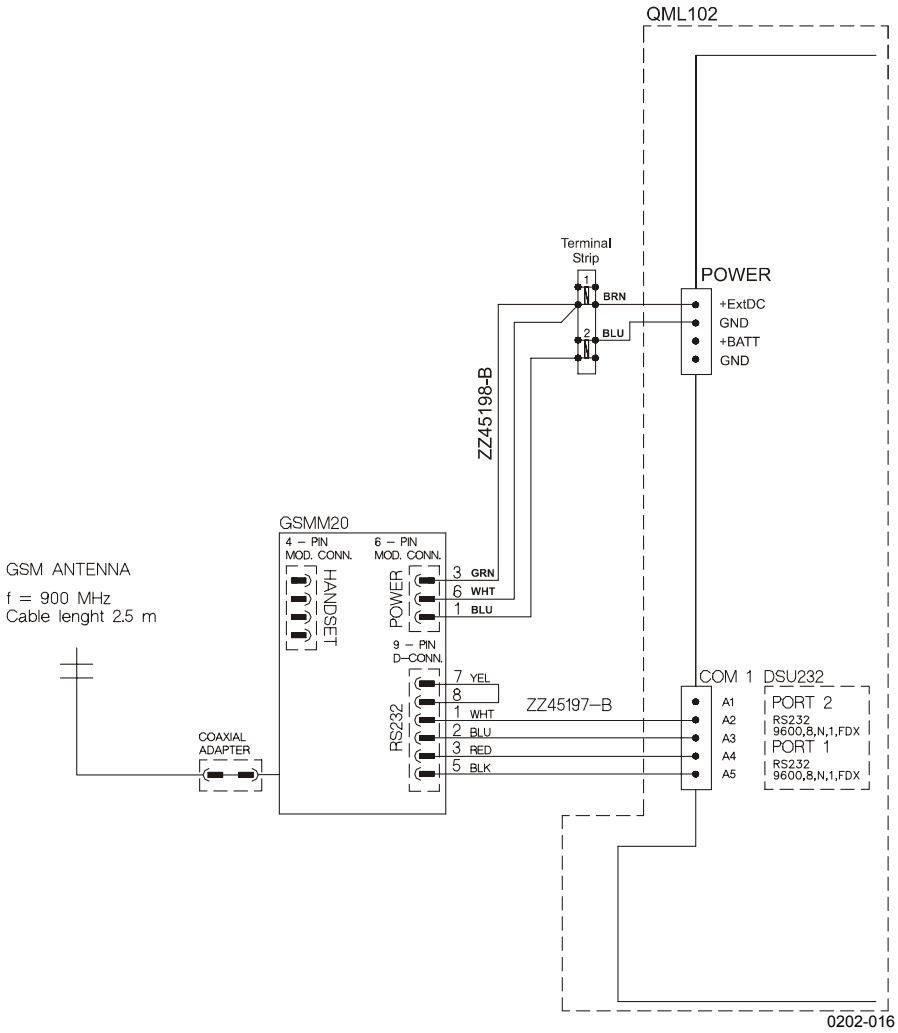


Figure 121 Wiring Diagram of GSM Modem

QMMODEM

The QMMODEM is installed on the door of the equipment enclosure. The connection cables are installed at the factory. Figure 122 on page 123 illustrates the wiring.

After the cables are connected, configure the communications module with the MAWS Lizard setup software. For more information, refer to the separate Technical Reference.

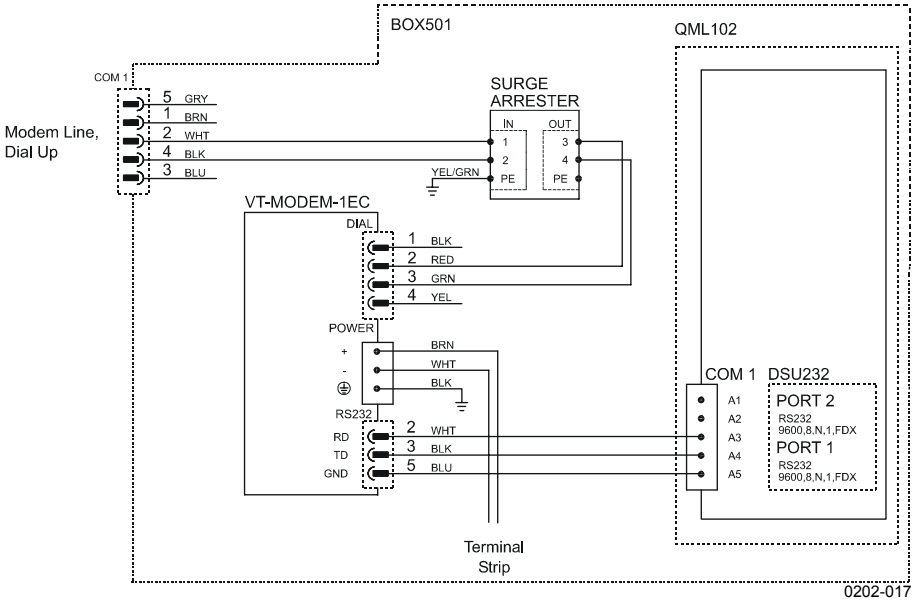


Figure 122 Wiring Diagram of QMMODEM

Satellite Radio Transmitters

The satellite radio transmitters are installed on the door of the equipment enclosure. Normally, the connection cables are installed at the factory and you can start by configuring the transmitter.

ORBCOMM

The ORBCOMM satellite transmitter is connected to an RS-232 communication port. It is recommended to install the DSU232 communication module on the logger to keep the COM0 port free for service use. By default, the DSU232 module is connected to the COM1 port.

1. Install the transmitter with the provided installation accessories to the door of the enclosure.
2. Connect the wires as shown in Figure 123 on page 124.

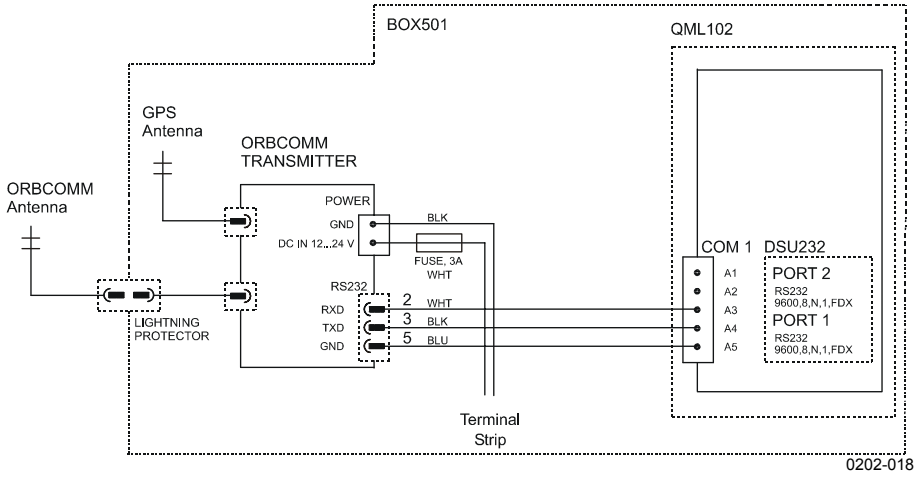
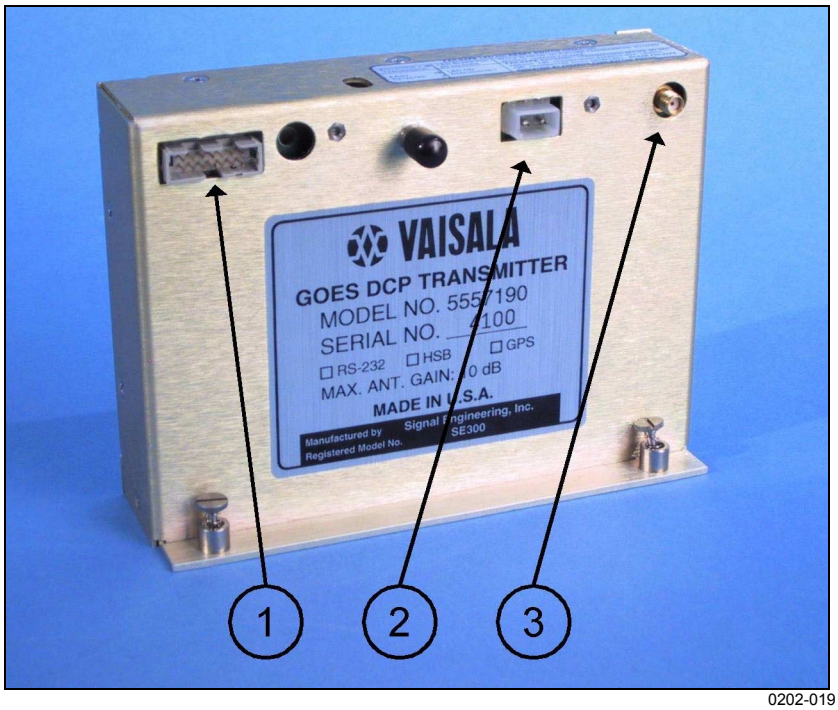


Figure 123 QRB101 Wiring Diagram

QST101

The QST101 transmitter is connected to an RS-232 communication port. It is recommended to install the DSU232 communication module on the logger to keep the COM0 port free for service use. By default, the DSU232 module is connected to the COM1 port.

1. Install the transmitter with the provided installation accessories to the door of the enclosure.
2. Connect the internal antenna cable to the QST101 antenna connector (3 in Figure 124 on page 125). The internal antenna cable is the one inside the enclosure leading from the bottom plate connector to the QST101 antenna connector.
3. Connect the internal and external cables as instructed in step a or b below:
   a. When the overvoltage protection device of antenna is installed, connect the internal and external antenna cables to the corresponding connectors of the overvoltage protection device.
   b. When overvoltage protection device of the antenna is not installed, use the hole in the base plate for antenna installation. Insert the provided washer to the internal antenna cable's connector and then the connector to the hole and tighten the bolt. Keep the connector in the center of the hole to ensure proper connection between the rubber washer and the gland plate. Connect the external antenna cable. Tighten the external antenna cable to the bottom plate connector by hand, do not use any tools.



0202-019

Figure 124 QST101 Connectors

4. Connect the data cable to the data port of QST101 (14-pin flat cable connector, that is, number 1 in Figure 124 above) and to the COM1 or COM2 port of the logger. You have to install the DSU232 communication module to the corresponding communication port of the logger. For installation instructions, see section Communication Modules on page 115.
5. Connect the power cable to the power connector of QST101 (2-pin white connector, number 2 in Figure 124 above) and to 12V power supply pins of the terminal strip. The red wire is for +12V and black wire is for 0V. Connector to the QST101 can be inserted only in one way.

CAUTION	It is important to connect the polarity correctly. The red wire is for +12V and the black wire is for 0V.

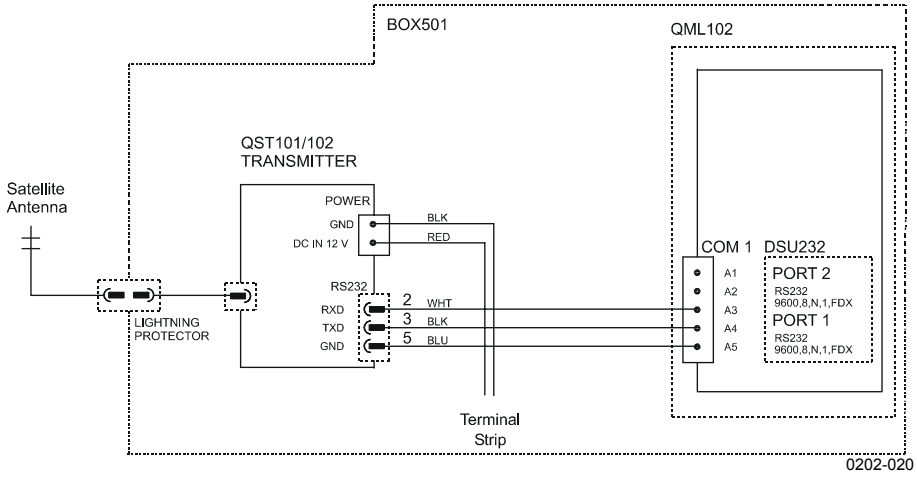


Figure 125 QST101 Wiring Diagram

After the cables are connected, configure the transmitter with the MAWS Lizard setup software. For more information, refer to the Technical Reference.

Installing Accessories

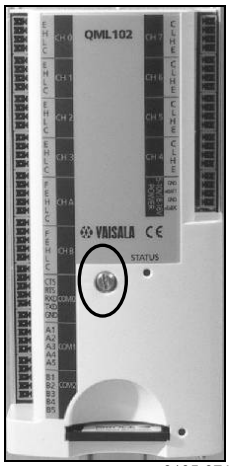
Internal Battery

The MAWS301 system usually uses large backup batteries. Therefore, the internal battery QMB101 is optional and is used only if backup battery is not used. The QMB101 battery is placed on top of the circuit board, under the logger cover.

NOTE	When a 12 V backup battery is used, it is recommended that QMB101 is disconnected by removing the red battery connector from the CPU. This way the current consumption will be reduced when charging circuits of QMB101 are not in use.

If you do not have backup batteries, the internal battery should be installed when the weather station is in operational use. The battery supplies backup power to the station and is needed for keeping the time and date information.

1. Open the logger's cover screw and remove the cover.



0105-074

Figure 126 Logger's Cover Screw

2. Insert and connect the internal battery. Attach the flat connectors to the plugs: red wire to terminal +, black wire to terminal -. The battery lead is disconnected during shipping. It is recommended to disconnect the lead if the station is not used for several weeks (no charging). When storing the station for a few days, use the **SLEEP** command to reduce power consumption and discharging of the battery.

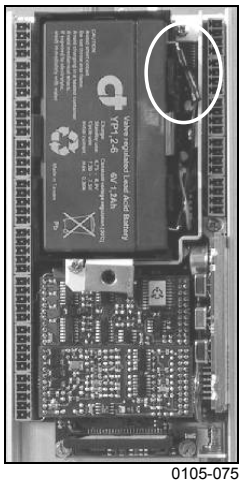

0105-075

Figure 127 Battery Connectors

External Memory Expansion Board

1. Open the screw on the logger cover and remove the cover.
2. Remove the communication modules (if any) from the circuit board.

CAUTION Be careful not to bend the connector pins.

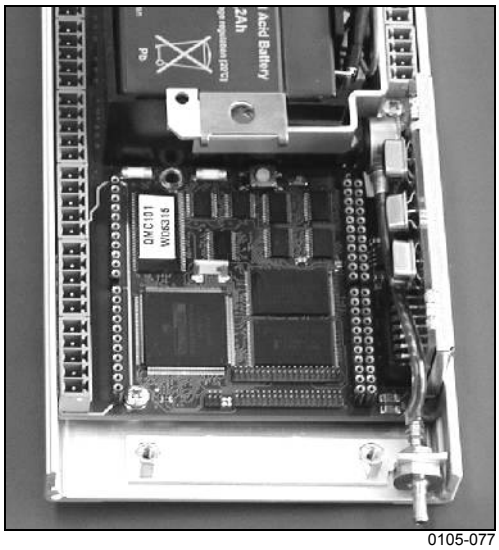


Figure 128 Communication Modules Removed

3. Align the pins on the QMC102 memory board with the slots on the logger and push the board back into its place.
4. Secure the board with a lock bar (number 2 in Figure 129 below) using the screw 1 and a long screw at the rear side of the logger. Attach also the screws 3 and 4.

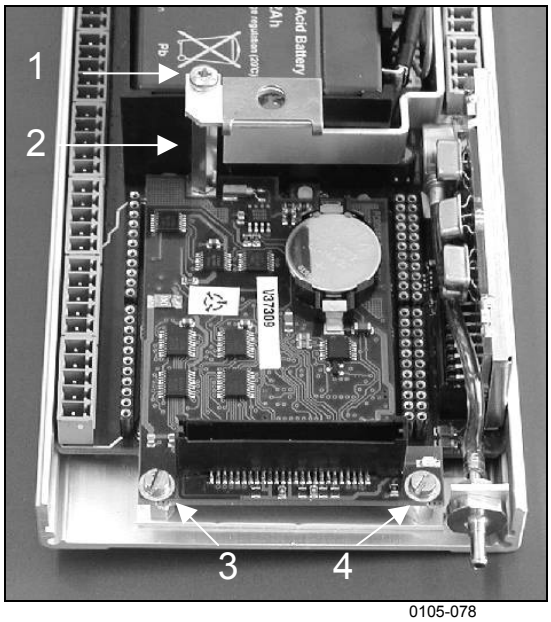


Figure 129 External Memory Expansion Board Installed

GPS Time Synchronizing Unit

Install the GPS unit QMG101 to the support arm as shown in Figure 130 below.

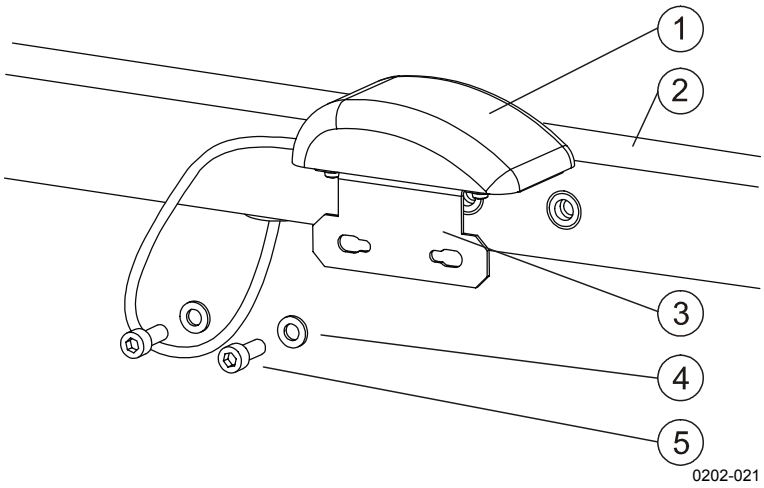


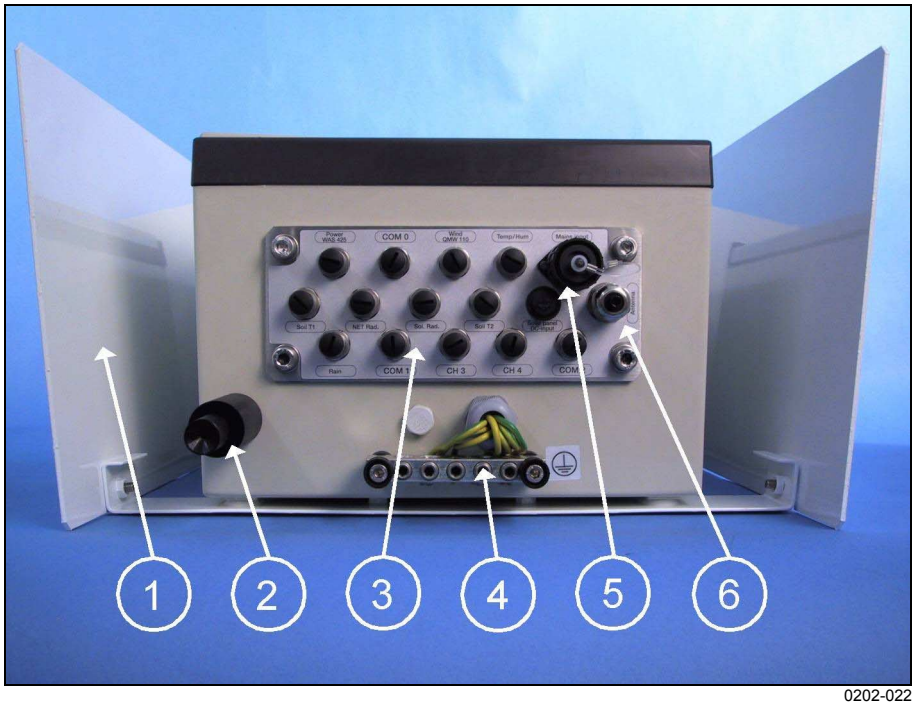
Figure 130 QMG101 Attachment

1. Attach the plate (3) to the sensor arm (2) with the provided spacers (4) and bolts (5).
2. Lead the sensor cable through the opening inside the sensor arm (1).
3. Connect the signal cable to **COM1** at the bottom of the equipment enclosure (see section Connecting Cables below). You have to install the DSU232 communication module to the corresponding communication port of the logger. For installation instructions, see section Communication Modules on page 115.

Connecting Cables

All sensors, power supplies and communication devices are connected to MAWS via environmentally sealed connectors. All the connectors are located on the bottom flange of the BOX 501. The connectors are placed and named as shown in Figure 131 on page 130.

NOTE	Be careful not to bend the connector pins when connecting cables.



0202-022

Figure 131 Connectors of BOX501 Enclosure

The following numbers refer to Figure 131 above.

1 = The radiation shield
2 = The static pressure head
3 = The sensor and communication connectors
4 = The grounding rail
5 = The input power connectors
6 = The antenna connector

Wiring Diagram

For the basic set of sensors, the wiring has been done at the factory according to Figure 132 on page 131. Do not change the wiring between the connectors and logger pins. For special deliveries or with some sensors, a separate wiring diagram is supplied in order to help you connect the sensor wires to correct connectors. The numbers next to the plug connectors indicate poles for connection wires.

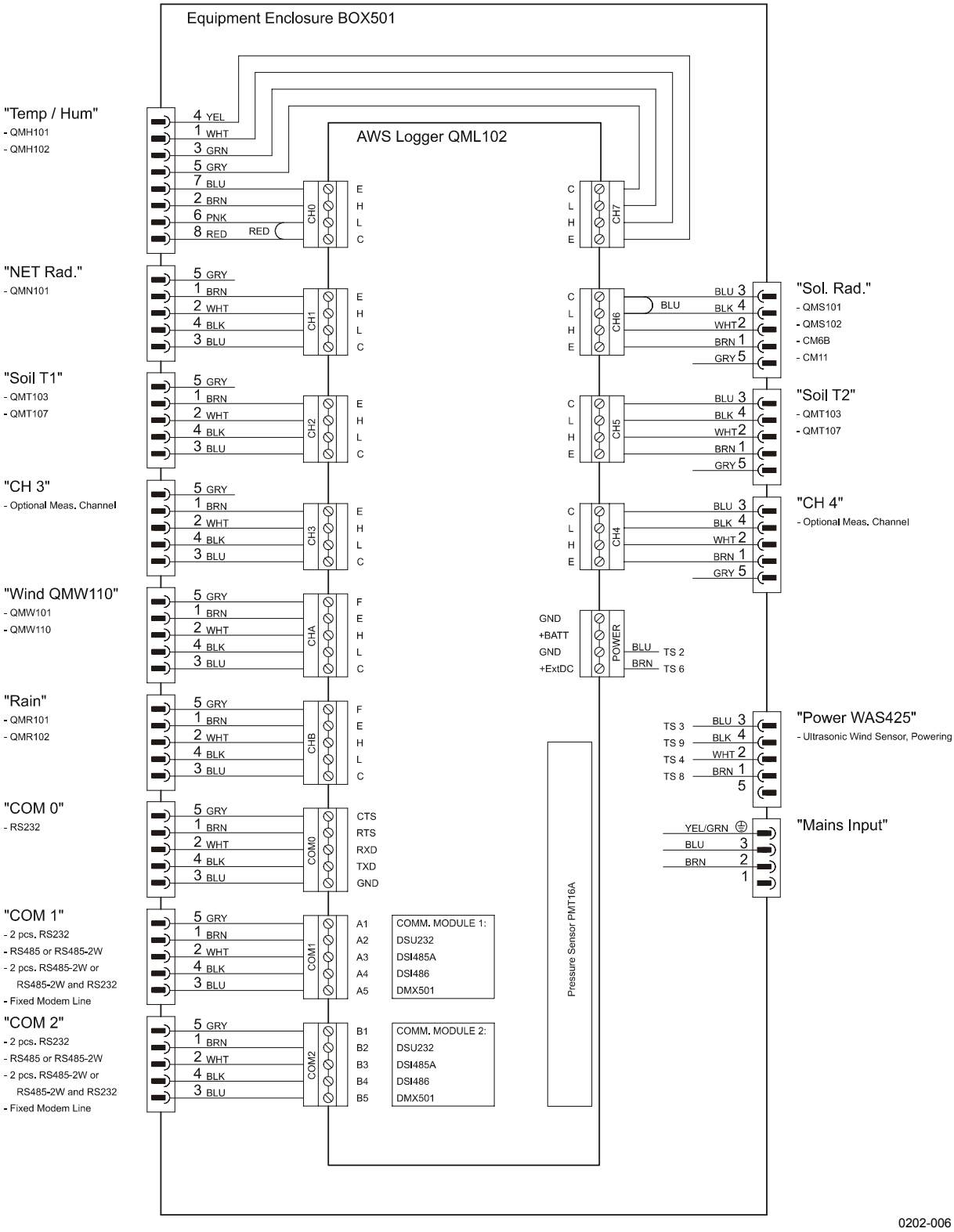


Figure 132 MAWS301 Basic Wiring Diagram